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1 INTRODUCTION

1.1 General

The Operation and Maintenance Manual for the City of Plummer wastewater treatment plant consists of three parts. Part 1 is this written volume that describes the various aspects of the system and the operation of its components. Part 2 consists of the record or "as-built" drawings for the new facility. Part 3 consists of equipment manuals provided by the equipment manufacturers. The parts of this manual are intended to be used together as a collective whole to present all components of the plant as a working whole.

The contents of this manual are presented in multiple sections that describe each component or process. The sequence of the sections within this binder follows the sequence of the flow in the plant from the headworks to disinfection.

This manual is as complete as possible and should be consulted frequently for operation purposes and before undertaking any maintenance or repairs. Some sections contain general background information and process descriptions that would be useful for a new operator, but may not necessarily benefit a more experienced operator other than giving insight into the intentions of the facility's design.

This manual is for reference and is not to be considered the final authority on the daily operation of the system. It is encouraged that this manual be a "working document" so note pages are included to allow observations and comments which may help improve the plant's operation and efficiency. This will help transfer the nuances of the plant operation from present operators to ones who will be employed by the City in the future.

1.2 Manufacturer's Operation and Maintenance Information

In Part 3, the operation and maintenance manuals of individual pieces of process and plant equipment are contained in a set of several binders. Table 1, below, is a quick reference guide to the manufacture's information. Copies of the set of nine binders that compose Part 3 of this operation and maintenance manual should be kept within the treatment plant's office and in another central location in the City, e.g. the Public Works building or City Hall.

Table 1 – **Manufacturer's Operation and Maintenance Manual Table of Contents**

Subject	Volume
General	1
Mechanical/Electrical	2
AeroMod – Extended Aeration	3
AeroMod – Dewatering	4
Phosphorus Removal	5 & 6
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2 DEFINITIONS AND GLOSSARY

2.1 General

The activated sludge process is a fundamental type of wastewater treatment process that is somewhat simple in concept but involves a number of different variables that must be tuned together for successful treatment. The following are definitions of some of the key terms that are important to the understanding and operation of an activated sludge treatment process.

2.2 Definitions

Active Metabolism: A description of the life processes of activated sludge organisms that occur when activated sludge organisms are in an active growth phase, adding cellular mass.

Adsorption: The process of attraction of atoms or molecules from an adjacent gas or liquid to an exposed solid surface. Such attraction forces align the molecules into layers ("films") onto the existent surface.

Belt Filter Press: A biosolids/sludge dewatering device that applies mechanical pressure to a chemically conditioned (usually polymer) sludge slurry sandwiched between two tensioned belts. The process removed water, reducing the final volume of the wasted sludge.

BOD_5: Five day biochemical oxygen demand; a measurement of the strength of influent and effluent wastewater

Bulking Sludge: Sludge with an increased volume within the clarifier due to an increase in MLSS with poor settling characteristics. Bulking sludge is classified as filamentous or viscous. Filamentous bulking sludge is the most common and is caused by the growth of organisms that can grow in a filamentous form (long chains) in adverse conditions.

Coagulant: A chemical added to a water stream to destabilize particles.

CF, cf, cf^3: Cubic feet, a measurement of volume.

CFM, cfm: Cubic feet per minute, usually pertains to air delivery.

CFS, cfs: Cubic feet per second, usually pertains to wastewater flows.

Denitrification: The processes in which chemically bound oxygen is stripped away from nitrates or nitrites for biological organism use. Nitrogen gas formation is a byproduct of the chemically bound oxygen removal. The nitrogen gas, released from the liquids in which denitrification is occurring, is in the form of insoluble, tiny bubbles. While the release of the gas bubbles is not harmful, a common side effect can be extremely detrimental. This side effect causes the gas bubbles to cluster together, beneath pieces of sludge in final clarifiers, which causes the solids to rise to the water surface. This gas lifted sludge can easily escape the final clarifier, causing increased solids content and BOD in the effluent.

DEQ: Idaho Department of Environmental Quality

DO: Dissolved oxygen, generally a concentration expressed in mg/L.

Endogenous Metabolism: The life process of activated sludge organisms when no net cell production occurs and the organisms utilize their own cell material for a food source.

Extended Aeration: A type of activated sludge process with no primary settling and a long aerobic detention time to generate less excess sludge.

Ferric Sulfate: Otherwise known as Iron(III) sulfate. Usually yellow to red in color, this rhombic crystalline salt is soluble in water at room temperature and used as a coagulant in wastewater applications.

Filaments: An organism that forms long strands or strings as it grows, also known as filamentous growth

Floc: Formation of clusters of cells and other materials as they are allowed to collide and coagulate (come together).

Food to Micro-Organism (F/M) Ratio: The F/M ratio is used to relate the concentration of available food to the concentrations of organisms available for treatment. The F/M ratio is equal to the pounds per day of influent BOD in the aeration basin divided by the pounds of MLSS present in the aeration basin. The F/M ratio is always reported as pounds of BOD/pounds of MLSS per day.

GPD, gal/day: Gallons per day, a measurement of flow.

HOA: "Hand", "Off", "Auto" Switch on a pump control panel

HP: Horsepower

KW: Kilowatt, a measure of electrical power.

KWH: Kilowatt hour, a measure of electrical energy usage.

LF: Linear feet, a measurement of length.

Lysing: The breakdown of cells, often by an external influence, which releases organic matter.

Mixed Liquor: The term used to describe the contents of the aeration basin.

Mixed Liquor Suspended Solids (MLSS): The suspended solids within the mixed liquor. For example, if a fixed volume sample (i.e. one-liter) of mixed liquor was filtered and the material caught on the filter paper were dried and weighed, the mixed liquor suspended solids concentration would be numerically equal to the milligrams of dried solids filtered from the volume of mixed liquor.

MGD: Million gallons per day, a measurement of flow.

mg/L: milligrams per liter, a concentration.

NH_3: Ammonia

NH_3-N: Ammonia measured as nitrogen.

Nitrification: The process where nitrogen (as ammonia nitrogen or nitrite nitrogen) oxidizes to the nitrate stage.

NO_3: Nitrate

NO_3-N: Nitrate measured as nitrogen.

NO_2: Nitrite

NO_2-N: Nitrite measured as nitrogen

NPDES: National Pollutant Discharge Elimination System, the federal wastewater discharge permitting system.

Organic Matter: All degradable organics, living material containing carbon compounds which are used as food by micro-organisms.

Oxidation: Combining elemental compounds with oxygen to form a new compound, results in the loss of electrons. A part of the metabolic reaction.

Oxygen Uptake Rate: The rate at which oxygen is consumed by the activated sludge, commonly expressed as the pounds of oxygen used per hour.

Particulate: Free suspended solids

pH: The measure of acidity and basicity of a solution. It approximates the negative base 10 logarithm of the molar concentration of dissolved hydrogen ions (H^+). A pH range below 7 (as low as just above 0) is acidic, a pH of 7 is neutral, and a pH above 7, up to a maximum value of 14, is basic.

Phosphate: A salt of phosphoric acid, often a limiting nutrient in environments as its availability governs the growth rate of organisms. In high concentrations in natural environments, reactive phosphate can cause the collapse of populations due to increased algae blooms which deplete the amount of available dissolved oxygen.

PPD, lbs/day: Pounds per day.

Recirculation Ratio: Routing return sludge to the aeration basin, it is necessary to pump a continuous volume of return sludge. The quotient obtained by dividing the volume of the returned sludge by the volume of incoming raw waste flow is the recirculation ratio.

Respiration: The process an organism uses to supply itself with oxygen and release carbon dioxide.

Return Activated Sludge (RAS): The settled solids from a final clarification basin that are returned to the previous aeration basin.

RPM: revolutions per minute, used in indicating the speed of a motor.

SF: Square feet

SLR: Solids loading rate

Sludge Age or Mean Cell Residence Time (MCRT): The length of time in days the average particle of activated sludge remains in the system before being wasted. The MCRT is an important indicator of the activated sludge system's activity.

Sludge Density Index: A settling characteristic of activated sludge. It is numerically equal to 100 divided by the sludge volume index. As an example, the sludge density index of the mixed liquor described below would be numerically equal to 100 divided by 100 or 1. From this it may be seen that if a mixed liquor has a sludge volume index of 100, the sludge density index would be 1; or if a mixed liquor had a sludge volume index of 200, the corresponding sludge density index would be equal to 0.5.

Sludge Volume Index (SVI): The SVI indicates the settleability of the sludge. It is the volume, in milliliters, occupied by one gram of solids in the mixed liquor after a 30-minute settling period. It can be computed by dividing the volume occupied by settled sludge after 30 minutes of setting time by the mixed liquor suspended solids concentration and multiplying by 1,000. As an example, assume that the mixed liquor in an aeration basin is tested and found to contain a solids concentration of 3,000 mg/L. If a sample of this mixed liquor is collected and then allowed to settle for 30 minutes in a graduated cylinder and if the volume of the settled sludge after 30 minutes is found to be 300 milliliters, the sludge volume index can be computed as follows:

$$300\ \text{mL}/3000\ \text{mg/L} * 1000 = 100$$

The SVI of this particular aeration basin mixed liquor would be 100.

Soluble: Matter or compounds capable of dissolving into a solution.

Stabilized: Not capable of any further change

Static Screen: A preliminary screen for primary wastewater treatment with no moving parts that is effective at removing large solids prior to entering the treatment processes of the wastewater plant.

Suspended Solids: Solids floating in an aqueous solution that can be filtered out via a laboratory filter.

Synthesis: The breakdown of organic compounds and conversion of these elements into new cell growth. This is an energy intensive process.

TKN: Total kjeldahl nitrogen, the sum of organically-available nitrogen (ammonia-NH_3 and ammonium-NH_4^+) in the chemical analysis of water and wastewater.

TSS: Total suspended solids, a measurement of wastewater strength

UV Disinfection: Ultraviolet radiation, a system used for wastewater disinfection

VFD: Variable frequency drive, a variable speed controller for motors using the principle of converting alternating current to direct current, then reconverting to alternating current at a controllable frequency.

Waste Activated Sludge (WAS): The portion of settled solids from the final clarifier which are removed from the activated sludge system to the aerobic digester to be further treated prior to disposal.

3 TREATMENT SYSTEM BACKGROUND

3.1 General

The City of Plummer, a municipal corporation located in Benewah County, Idaho, owns and operates its wastewater collection and treatment system. Decisions involving daily wastewater system operations are made by the plant operator and by the Public Works Director. Financial decisions regarding major wastewater system improvements and establishment of sewer rates are made by the Plummer City Council. The following parties are involved in the operation, maintenance and planning for the Omak wastewater collection and treatment facilities:

Owner/Operator:
City of Plummer
P.O. Box B
Plummer, ID 83851
Phone: 208-686-1641 (City Hall)
208-686-0917 (Wastewater Treatment Facility)
Mayor: Tim Clark
Public Works Director: Rod Willard
Treatment Plant Operator: Paul Sifford

Engineer:
USKH, Inc
621 W. Mallon Ave
Ste. 309
Spokane, WA 99201
Phone: 509-328-5139
Project Manager: Alan Gay, P.E.

For a detailed discussion of Plummer's collection system, please see the September 2007 Engineering Report for Wastewater Facilities document.

The City of Plummer's wastewater treatment lagoons were originally designed in 1979 and constructed in 1981. The lagoon treatment system consists of five cells, including two aerated/facultative lagoons, a chlorine contact lagoon and two sand filters. The effluent from the lagoon treatment facility was released into Plummer Creek between mid-November and mid-May. The period between mid-May and mid-November when creek flows were below the allotted 10 times the average daily discharge from the lagoons, the effluent was discharged to a conventional land application system.

As the City of Plummer's population grew following the construction of the lagoon treatment system, the treatment began to grow less effective as flows increased. In August 2006 a building moratorium was issued by the City to prevent an increase in NPDES violations seen by the City. Additionally, concurrent studies in levels of phosphorus present in surface water bodies of the inland northwest sparked changes in effluent concentrations of the future NPDES permit. The moratorium sparked an initiative within the City of Plummer to investigate alternatives for their future wastewater treatment.

The chosen alternative from both the 2007 Facilities Plan and the 2008 Design Report select an extended aeration mechanical plant for primary treatment followed by up-flow sand clarifiers for tertiary phosphorus removal.

The City of Plummer's wastewater treatment plant accomplishes secondary treatment of wastewater using an AeroMod extended aeration activated sludge treatment process and tertiary treatment via Blue Water BluePRO upflow sand clarifiers. Wastewater enters the influent lift station via the existing trunk line that fed the City's lagoon system and is lifted by one of two 833 gpm pumps to the plant's headworks. The headworks for the wastewater plant consist of a set of two 48-inch Hydrasieve static screens that remove solids, by gravity, that can interfere with the downstream mechanical processes. If the static screen is out of service, there is a back up unit (also to be used during times of high flow) that can be utilized, or the entire plant's headworks can be bypassed, if needed. Wastewater then flows initially into the fermenter tank of the extended aeration treatment basin, and then into the completely-mixed anaerobic tank. From the anaerobic tank, the wastewater is split into two identical treatment trains and goes through first and second stage aeration followed by final clarification. Coarse bubble aeration within the aeration basins provide oxygen and keep the wastewater and bacteria mixed and in suspension. Effluent from the two clarifiers flows over the effluent weir box and then by gravity in a 10-inch DI pipe to the tertiary phosphorus removal filters.

The wastewater is injected with a ferric sulfate solution prior to entering the first pass of filters. As the wastewater leaves the 1st pass of filters, additional ferric sulfate is added to the wastewater. After this chemical injection, the wastewater enters the second set of filters and, once filtered, flows out by gravity to the ultraviolet (UV) disinfection system. From the UV disinfection system, the wastewater enters the effluent lift station, where one of two 833 gpm vertical turbine pumps lifts the disinfected wastewater to the subsurface wetland discharge area that indirectly feeds Plummer Creek.

Solids that are removed from the clarifier are returned to the anaerobic basin at the head of the extended aeration and mixed to aid in denitrification and biological phosphorus uptake. Solids are also wasted from the 1st stage aeration basin to the aerobic digester where it is held before being pumped from the digester to the dewatering system. The waste activated sludge is dewatered via belt filter press and is then collected. The dewatered Class B biosolids are land applied by the City on a city owned parcel located north of the treatment plant.

The Plummer wastewater treatment plant is designated a Class III facility by IDEQ based on the designed treatment processes and influent flow. As a result, a Class III certified operator is required to be responsible for day-to-day operation of the facility, but a Class II certified operator can be in charge during all regularly scheduled shifts.

4 TREATMENT STANDARDS AND REQUIREMENTS

4.1 Wastewater Requirements

Both the Idaho Administrative Procedures Act (Chapter 58) and the Federal Clean Water Act require wastewater treatment plants to operate under the terms and conditions set forth in a liquid waste discharge permit (NPDES permit). The City's current NPDES permit (ID-002278-1), issued by the United States Environmental Protection Agency, Region 10, with an effective date of September 1, 2005, contains effluent limitations, requirements for the treatment, handling, use of and disposal of sludge, monitoring and reporting requirements, and procedures for reporting discharges that exceed the permitted discharge limits. A copy of the City's EPA-accepted 2009 application for a new discharge permit, and a copy of the notice of completeness for that application from EPA is attached in Appendix B of this manual.

Table 2 below shows the effluent discharge limits set forth under the 2010 Permit.

Table 2 –**City of Plummer 2009 NPDES Permit Application Proposed Parameters**

Parameter	Average Monthly	Average Weekly
BOD	10 mg/L, 90% removal, 27 lb/day	10 mg/L, 90% removal, 40 lb/day
TSS	5 mg/L, 95% removal, 14 lb/day	10 mg/L, 90% removal, 40 lb/day
Turbidity	2 NTU**	5 NTU***
Fecal Coliform	2.2#/100 mL	---
TP	0.025 mg/L	0.05 mg/L
TN****	1.5 mg/L	2.5 mg/L
Flow	0.475 mgd Peak Daily, 0.315 mgd Average Monthly	
pH	Daily minimum >=6.5, Daily maximum <=9	

*Adapted from ERWF Table 4-5, and modified for Class A reuse standards
** NTU = nephelometric turbidity units
*** Instantaneous peak limit
**** Total N as Ammonia

The City's current permit also contains testing requirements for both the wastewater and the discharge water body (Plummer Creek). These testing requirements can be found below in Table 3.

Table 3 – **Plummer Proposed Sampling Schedule**

Plummer Wastewater Sampling Schedule					
Category	**Parameter**	**Units**	**Sample Point**	**Sampling Frequency**	**Sample Type**
Wastewater Influent	BOD_5	mg/L	Influent	1/week	24 hr Composite
Wastewater Influent	TSS	mg/L	Influent	1/week	24 hr Composite
Wastewater Influent	BOD_5	lbs/day	Influent		Calculation

Wastewater Influent	TSS	lbs/day	Influent		Calculation
Wastewater Effluent	BOD_5	mg/L	Effluent	1/week	24 hr Composite
Wastewater Effluent	TSS	mg/L	Effluent	1/week	24 hr Composite
Wastewater Effluent	BOD_5	lbs/day	Effluent		Calculation
Wastewater Effluent	TSS	lbs/day	Effluent		Calculation
Wastewater Effluent	Fecal Coliform Bacteria	#/100 ml	Effluent	1/week	24 hr Composite
Wastewater Influent	TP		Influent	1/week	24 hr Composite
Wastewater Effluent	TP		Effluent	1/week	24 hr Composite

It is anticipated that when issued, the City's new NPDES permit will require the plant operator to act immediately in cases where effluent discharge limits are unable to be met. The plant operator must notify EPA Region 10 and the Couer d' Alene Tribe Water Resources Department.

4.2 Biosolids Requirements

The solid byproduct of treated wastewater also known as sludge or biosolids is regulated under the Federal Sludge Regulations, 40 CFR Part 503 as well as in the IDAPA 58.01.16. Only the federal regulation sets forth pollutant concentrations for the sludge (or cumulative loading rates of the pollutants in the soil where they are applied), pathogen reduction requirements, and vector attraction reduction requirements.

4.3 Reuse Requirements

On June 12, 2009, a waiver was issued by DEQ regarding use of irrigation of treated wastewater within the project site in accordance with four conditions. These conditions include use of purple colored piping, application of final effluent of no more than 5,000 gallons per day, application in a manner that avoids ponding or runoff, and reporting of any instances of non-compliance to DEQ. Operators are to observe these conditions at all times. Purple pipe signifying reuse has been installed in all irrigation piping, and all feed piping from the re-use storage and pumping system in T1 and the sludge drying room of the Mechanical Building.

5 TREATMENT SYSTEM DESCRIPTION AND PROCESS CONTROL

5.1 System Description

The Plummer wastewater treatment plant accomplishes tertiary treatment of wastewater using an extended aeration activated sludge process followed by up-flow sand filtration (for phosphorus removal). The major components of the City of Plummer's wastewater treatment plant are as follows. Please see Figure 2 for a site plan.

1. Influent Lift Station
2. Headworks
3. AeroMod Extended Aeration Package Plant
    a. Bio-P Fermenter Tank
    b. Bio-P Anaerobic Tank
    c. 1st Stage Aeration Basin (2)
    d. 2nd Stage Aeration Basin (2)

    e. Final Clarifier (2)
4. 1st Pass Phosphorus Removal Filters (2)
5. 2nd Pass Phosphorus Removal Filters (2)
6. UV Disinfection System
7. Effluent Lift Station
8. Sludge Dewatering System
9. Sludge Storage Area
10. Operation and Mechanical Buildings
11. Stand by Electrical Generator

Wastewater enters the treatment system at the influent lift station where one or both 417 gpm variable-frequency driven solids-handling pumps lifts the raw wastewater to the headworks. At the headworks of the plant, located in the Operations Building, the wastewater cascades over one (or both during periods of high flow) 48-inch Hydrasieve static screen for removal of influent solids. If one screen is out of service, the other can be used while maintenance is being performed, if both screens are out of service, the headworks can be bypassed entirely, although this is not preferable due to solids impacting the performance of the extended aeration basin. Wastewater flows by gravity from the headworks into the AeroMod Extended Aeration Packaged Treatment Plant, where biological wastewater treatment occurs via contact with and metabolism by bacteria (activated sludge).

The extended aeration treatment unit is an 85'x65' common wall treatment tank that has been subdivided into 10 individual partitions. Wastewater flows by gravity from the static screens and enters the Bio-P Fermenter tank then flows into the Bio-P anaerobic tank which aids in nutrient removal. From the anaerobic tank, the flow is split into two (2) identical trains that provide redundancy, a requirement of IDAPA 58.01.17 for Class A reuse effluent. These two trains consist of 1st and 2nd stage aeration and final clarification. Coarse bubble diffusers in the aeration basins provide oxygen and keep the wastewater and bacteria mixed and in suspension.

Table 4 – **Plummer Wastewater Treatment Plant Design Criteria**

General	
Average Monthly Flow	0.315 MGD
Maximum Daily Flow	0.475 MGD
Instantaneous Peak Flow	0.630 MGD
BOD Influent Loading	525 lbs/day
TSS Influent Loading	525 lbs/day
Phosphorus – P Influent Loading	21 lbs/day
Influent Lift Station	
Pumps (2)	417 gpm each
Pump Type	Submersible
Headworks	
Static Screen (2)	Hydrasieve, 48 –inch wide
AeroMod Extended Aeration Basin	
Bio-P Fermentor/Selector Tanks (2)	
Volume	35,343 gallons
Depth	14 feet

.286 mg

Retention Time (Design + RAS)	1.3 hrs
1st Stage Aeration Tanks (2)	
Volume, total	134,060 gallons
Depth	14 feet
2nd Stage Aeration Tanks (2)	
Volume, total	133,797 gallons
Depth	14 feet
Hydraulic Retention Time	20 hours
Organic Loading	15 lb BOD/1000ft3
MLSS Concentration	~ 3,000 mg/L
F/M Ratio	0.08 lbs BOD5/lbs MLSS
Coarse Bubble Diffuser Submergence	12.50 ft
O2 Required	38.9 lb/hr
MLSS Wasted per Day	290 lbs/day, 11,556 gal/day
Final Clarifiers (2)	
Volume, total	83,776 gallons
Depth	14 feet
RAS Recycle Rate	100%
Retention Time	6.4 hours – Design 2.5 hours – Maximum
Surface Overflow Rate	394 gpd/sf 1,000 gpd/sf - Maximum
Weir Overflow Rate	4,257 gpd/lf – Design 10,811 gpd/lf - Maximum
Solids Loading Rate	19.8 lbs/day/sf – Design 29.0 lbs/day/sf – Maximum
Aerobic Digesters (2)	
Volume, total	70,716 gallons
Depth	14.5 feet
Solids Wasting Rate	258 lbs/day
Digester Sludge Age	30 days
Volatile Solids Reduction	17.6%
Air Required for Stabilization	55 cfm
Air Required for Mixing	204 scfm (@ 20scfm/1000cf)
Maximum MLSS Concentration	12,000 mg/L
Maximum MLSS, %	1.20%
Advanced Phosphorus Removal Filtration System	
1st Pass Filter (2)	CF-64
2nd Pass Filter (2)	CF-64
Design Loading Rate	2.85 gpm/SF
Air Lift	2.0"
Back Pressure	10-15 PSI
Bed Turnover Rate	0.2-0.4 in/min
Typical Operating Headloss	25"-35"

Nominal Influent Rate	224 gpm
Reject Rate	14-16 gpm

6 UNIT PROCESS DESCRIPTIONS AND OPERATIONS

6.1 General

The purpose of the activated sludge treatment system is to remove dissolved organic matter and suspended colloidal solids from wastewater. Wastewater is introduced into a biological reactor that contains a high concentration of actively growing microorganisms as well as dissolved oxygen. The incoming waste is used by the microorganisms as a food source which enables necessary their life processes while simultaneously transforming the waste material into a more stable end product. The rapid growth of the microorganisms due to the constant food source influx results in a biological mass that can be removed by settling, thereby creating a relatively clear, denatured effluent. In the activated sludge process, the concentration of the active biological mass is kept at elevated levels by constantly re-circulating microorganisms back into the aeration system. The active organisms are kept within the basin, and are continually used over and over again, keeping the treatment system healthy and viable.

This section describes the operational characteristics, the intent behind the design, and a description of the actual operation of each of the treatment plant components and processes in the wastewater treatment facility.

6.2 Influent Lift Station

6.2.1 Background

The influent lift station receives wastewater from a 10-inch PVC gravity sewer line. The internal dimensions of the rectangular reinforced concrete wet well are 22-feet long x 12-feet wide x 8 ½-feet deep. The submersible pumps sit in a 2-foot deep sump that is 4 feet wide and 8-feet 8-inches long. The wet well is located within the City of Plummer's utility easement and is completely underground, accessible via a 72-inch x 48-inch traffic rated hatch. The controls for the lift station are located in NEMA 4x panels adjacent to the north end of the vault.

Wastewater enters the influent lift station, where one or both of the identical pumps lift the wastewater to the treatment plant's headworks. Both pumps are Hydromatic (Model H4HX) submersible pumps with a capacity of 417 gpm at a total dynamic head of 78 feet. The pumps are driven by 15 horsepower motors, operating on 460 volt, 3 phase current and are equipped with variable frequency drives.

Control of the start-stop operation of the two pumps is automatic and controlled by a pressure transducer/level system. The variable speed drives are designed to match pump capacity with the incoming flow of wastewater to the wet well and pump that quantity to the headworks, helping to minimize surging to the treatment plant. If one of the two pumps is taken out of service, the remaining pump has the capacity to accommodate the peak influent flow. The offsite influent lift station, as well as the entire wastewater plant, is connected to an onsite stand by generator. In the event of a utility power outage power will be supplied to the influent pumps via the stand by generation system. As an additional safety factor, the wet well has additional capacity to store several hours of incoming wastewater during a prolonged power outage.

6.2.2 Normal Operation

The variable speed pumps are controlled by pressure transducers, which sense the water surface elevation within the wet well, and a pump control panel which regulates the speed of the pumps to match the incoming flow. The pump controls are tied into the programmable logic controller which translates a signal to turn the pumps on or off based on the liquid level within the wet well. The pump controls are located north of the influent lift station and tie back into the motor control center located within the blower room of the Mechanical Building.

Under normal operating circumstances, the two pumps operate automatically based on the water surface elevation sensed by the pressure transducer. As wastewater enters the influent lift station wet well, LS-1, the internal water level rises until it reaches the normal operating level. Once this liquid level is reached, the lead pump slowly starts, speeding up to balance the inflow and the pump capacity, allowing the water level to remain steady. Even with slight changes in the water level, the pump speed changes to maintain the equilibrium between the pump capacity and influent flow. If the flow into the wet well drops off and falls below the pumps minimum capacity, the low level setting is reached and the pump shuts off.

The second pump within the wet well is for redundancy if the lead pump ever needs to be taken off line or malfunctions. The peak pump capacity of each individual pump is identical to the peak Phase I flow of 0.630 MGD, or 417 gpm. The second pump will be controlled automatically, identically to the lead pump. The pump operation will be cycled to prevent the solitary usage of a single pump. Should the liquid level within the wet well continue to rise, due to higher than normal flows or due to a pump failure, the high water alarm level will be reached, signaling the attention of the operator on duty. See the table below for a description of the operational settings for the influent pumps.

Table 5 – **Influent Lift Station Pump Settings**

Influent Lift Station (LS-1) Pump and Operational Settings	
Operation Level	**Operational Setting, feet MSL**
High Level Alarm	2643.38
High Level of Normal Range	2642.38
Normal Operating Level	2638.13
Low Level Alarm	2637.63

Figure 3 – Influent Lift Station shows the vaults and valves used to control the inflow to the wet well. See the table below for a normal LS-1 operation valve guide.

Table 6 – **Influent Lift Station Normal Operation**

Influent Lift Station (LS-1) Valve Position – Normal Operation			
Valve Number	**Description**	**Position**	**Function**
1	6" Gate	Open	Allows sewage to flow into FM-I from Pump No. 1
1*	6" Check		Prevents sewage from flowing backwards into the wet well following

			pump shut off
2	6" Gate	Open	Allows sewage to flow into FM-I from Pump No. 2
2*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off
3	6" Gate	Open	Allows sewage to flow into FM-I
4	6" Gate	Open	Allows sewage to flow into FM-I and isolates the pig valve in case of maintenance
5	6" Pig		Provides access into FM-I in the event of an obstruction
6	6" Gate	Open	Allows sewage to flow into FM-I and isolates the pig valve in case of maintenance
66	10" Gate	Closed	Allows sewage to flow into lagoons
67	10" Gate	Open	Allows sewage to flow into influent wet well

Each individual pump discharge line is equipped with an isolation valve so each pump can be isolated and removed from service without having to shut down LS-1 operation. Assuming all valves are positioned for normal operation, the valve positions shown below in Table 7 should be followed to take Pump No. 1 out of service.

Table 7 – Influent Lift Station, Pump 1 Offline

Influent Lift Station (LS-1) Valve Position – Pump 1 Offline			
Valve Number	**Description**	**Position**	**Function**
1	6" Gate	Closed	Prevents sewage from entering FM-I
1*	6" Check		Prevents sewage from flowing backwards into the wet well following pump removal
2	6" Gate	Open	Allows sewage to flow into FM-I from Pump No. 2
2*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off
66	10" Gate	Closed	Allows sewage to flow into lagoons
67	10" Gate	Open	Allows sewage to flow into influent wet well

Assuming normal operation, the valve positions shown below in Table 8 should be followed to take Pump No. 2 out of service.

Table 8 – Influent Lift Station, Pump 2 Offline

Influent Lift Station (LS-1) Valve Position – Pump 2 Offline			
Valve Number	**Description**	**Position**	**Function**
1	6" Gate	Open	Allows sewage to flow into FM-I from Pump No. 1
1*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off
2	6" Gate	Closed	Prevents sewage from entering FM-I

2*	6" Check		Prevents sewage from flowing backwards into the wet well following pump removal
66	10" Gate	Closed	Allows sewage to flow into lagoons
67	10" Gate	Open	Allows sewage to flow into influent wet well

The pumps individually discharge into a 4-inch pipe that is connected to a 6-inch common header and 6-inch discharge pipe that carries the wastewater to the headworks. In order to modify or repair the header, the operator should ensure that there is sufficient storage within the influent wet well or that emergency bypass provisions have been made. The influent forcemain to the headworks can now be drained by turning off all pumps and opening the check valves, allowing the sewage to flow back into the influent wet well. The discharge lines of each pump should then be closed while repairs are being performed.

Cleaning of the influent wet well should executed on a regular basis as a collection of debris and grit within the wet well, especially the sump area, can cause operational problems. The pump control elevations should also be checked periodically by physically measuring the water level in the wet well. Valves associated with the pump discharge should be exercised monthly to prevent the valve from freezing.

Several problems could affect the performance of the pumps, including plugging of the pump impeller, cavitation or excessive vibration, and electrical malfunction. The manufacturer's recommendations for problem diagnosis and associated maintenance requirements should be consulted by the operator when unsure of the necessary corrective action.

6.2.3 Electrical Controls

The 480 volt, 3 phase, electrical power for the influent lift station is provided by existing above ground power and is routed through a 15 KVA transformer to step down the voltage in order to feed lower voltage circuits. Circuit Breakers are located on the influent lift station control rack/board in the western-most panel on the rack. The LCP-2 panel, located on the east end of the rack, provides complete station control, including the alarm functions and the link to the SCADA system. The Duplex Pump Control Panel directly controls the pump operation and is provided by the pump's manufacturer.

The Influent Lift Station Duplex Pump Control Panel provides the features for control (speed, start-stop) of the two influent pumps based on a signal from the pressure transducer. The transducer provides a signal for the selection of the lead and standby pump and helps trigger lift station alarms. A programmable logic controller (PLC) provides the control functions, and an uninterruptable power supply is included to provide power to the PLC during power outages. Water levels used for pump operation (see Table 5) are programmed into the PLC. The face of the panel shows alarms for PLC fail and high wet well level, which can be acknowledged by pressing the "reset" button on the panel. Both the lead and standby pump can be selected. By selecting a pump for "lead" operation, that pump will start when a signal is received indicating the water level within the wet well has reached the level programmed to start the pump. By selecting a pump as "standby", that pump will be the last pump to start when the wet well level continues to rise to the point where a third pump is needed to keep up with incoming flow. It is important the lead and standby pump selectors are not set to the same pump. Alternating the lead and standby pump will allow the running hours on the pumps to be somewhat equal, which will help increase the longevity of the system.

Each of the two influent pumps is equipped with a variable frequency drive (VFD). The purpose of the VFD is to pace the motor speed based on the incoming flow rate and corresponding water level within the wet well. This variable flow rate improves treatment process performance by eliminating incoming wastewater surges. The VFDs act as the motor starters for the pumps and can be programmed through the keypad on the face of the local control panel, LCP-2. Switches are provided for HOA, start, stop, and VFD/Bypass selection and a disconnect for the bypass main and VFD main are provided. In the event of a VFD failure, the panels include the ability to bypass the VFD and operate the pump at full speed using the available line voltage. While the pump would continue to operate, the motor speed and pump capacity would not change as the water level in the wet well varied.

Under normal operation, the operator would select the lead and standby pumps on the Pump Control Panel. Each VFD would be set to "VFD" on the VFD/Bypass selection switch, with the HOA switch set to "Auto". The lift station would run automatically, using the pressure transducers to sense wet well levels, and the pump speed changing as needed to match incoming flows.

If the VFD component is not functioning, then the speed control component can be bypassed by setting the VFD/Bypass selector switch to "Bypass". When the HOA switch is in "Auto", the pump would then start when called by the control panel and run at full speed until signaled to stop (water surface elevation reaches the pump off level). To operate in manual mode, the HOA switch would be set to "Hand", and the operator can start and stop the pump using the "Start" and "Stop" buttons on the face of the VFD panel. The VFDs have other features that allow manual operation of the drives using the VFD keypad, such as placing the drive in "local" mode and changing the speed using the up and down arrow keys. The operator is referred to the VFD manual for operation of the devices. The operator should read the run time hours for each pump on a daily basis, and should keep an up to date log.

6.2.4 Stand By Generator Operation

The influent lift station is connected to the standby generation system. In the event of a failure of normal power to the influent lift station, the stand by generator, located north of the Mechanical building, will be automatically started and will remain in operation until power can be restored. The load is switched from the normal power supply to the stand by generator by means of an automatic transfer switch located in the blower room, next to the MCC. Other than brief outages when changing from utility power to the stand by generator (or vice versa) the influent lift station operation should be unaffected by the stand by power source.

6.2.5 Emergency Bypass

Most all the components of the Plummer WWTP can be bypassed in the event of an emergency. However, the influent lift station cannot be bypassed without significant damage to the surrounding grades and direct impact to the water quality of Plummer Creek. If an emergency bypass were to become necessary, the operator would excavate a channel from about 2-feet east of the collection system manhole on the south side of the influent lift station site. The channel would be routed south to allow discharge to main fork of Plummer Creek. The operator would then open valve 66 and close valve 67 to the lift station, allowing bypass. The operator must also notify EPA and Coeur d'Alene Tribe Water Resources within 24 hours of a beginning a bypass, estimate flow, and collect grab samples for analysis of BOD, TSS, and other effluent parameters required by the current NPDES permit.

6.3 Preliminary Treatment – Headworks

6.3.1 Background

Preliminary treatment refers to processes ahead of the AeroMod Extended Aeration Basin and following the influent lift station. The processes are conducted in the headworks, located in the Operations building, and consist of primary screening.

6.3.2 Static Screening

After the raw wastewater is lifted from the influent lift station to the headworks, the wastewater flows down and over a 48-inch static screen that removes large solids, preventing excess solids from entering the fermenter tank within the extended aeration treatment basins. There are two 48-inch static screens within the headworks, with room for installation of a third. One static screen is sized for screening the peak flow rate design of the wastewater treatment plant. The second screen is provided for treatment redundancy in the event one screen needs to be taken off line. The screens are manually cleaned and should be raked once a day to remove solids-build-up on the face of the screen. The solids are scraped off the face of the screen and are collected into solids bagging carts (via a solids chute mounted to the front of the screen) that allow the solids to dewater prior to disposal. During normal operation, the screens should be scraped once daily, and no less than every second day, and sprayed with a hot pressurized water stream once per week to remove grease build up.

The Hydrasieve Screens (model 554-2-48) are manufactured by Andritz Ruthner of Arlington, Texas. The stainless steel panels have a screened opening of 0.060 inches and are curved in the direction of the flow to maximize dewatering. The screen plate also has three distinct angles which allow for maximum dewatering potential and screening deceleration. The screen plate is supported by a frame that evenly distributes flow over the bars and accelerates the liquid down the screen plate. The filtered liquid collects in the screen base and is then carried via 10-inch ductile iron piping to the extended aeration treatment basins.

Additional information on the Hydrasieve screens may be found in Volume 1 of the contractor-supplied Operations and Maintenance Manuals.

See the following Table 9 for normal operation of a single static screen. The plant is designed to function with only one screen removing solids; however, the operator may choose to run both screens simultaneously. See Table 10 for valve positions to run both screens.

Table 9 – **Static Screen Normal Operation, Single Screen**

Static Screen Valve Position – Normal Operation – One Screen			
Valve Number	**Description**	**Position**	**Function**
8	6" Pig Receiver	Removed	Was designed to allow FM-I to be cleared of debris, works with Valve #5, the launching pig valve. With receiver removed, operator may operate by retrieving pig via blind flange on north face of screening influent manifold north of valve 9.
9	8" Gate	Open/Closed	Allows influent to be screened by Static Screen 1
10	8" Gate	Closed/Open	Prevents influent from being screened by Static Screen 2

Table 10 – **Static Screen Normal Operation, Both Screens**

Static Screen Valve Position – Normal Operation – Both Screens			
Valve Number	**Description**	**Position**	**Function**
8	6" Pig Receiver	Removed	Was designed to allow FM-I to be cleared of debris, works with Valve #5, the launching pig valve. With receiver removed, operator may operate by retrieving pig via blind flange on north face of screening influent manifold north of valve 9.
9	8" gate	Open	Allows influent to be screened by Static Screen 1
10	8" Gate	Open	Allows influent from being screened by Static Screen 2

Figure 4 depicts the wastewater treatment plant's headworks and identifies both the screens and the valves associated with the screen operation.

The headworks area of the wastewater plant is the area that has the highest potential for objectionable odor as raw solids can build up and will be left to dewater in the solids bagging carts. The screenings bagging area should be hosed down at least once per day to remove any solids or scum that has leached out of the porous bags while draining prior to disposal. Once the screenings within the bagging carts are sufficiently dewatered, the bags should be knotted, removed from the cart and disposed of in the onsite dumpster. The bags should be disposed of regularly to help reduce odors.

A 6-inch pig receiving port was originally designed to be located within the screening room to accept the pig from the launching valve in Vault V2. This receiving port contained 8 small diameter holes in an orifice plate that catch solids, mostly hair, pushed to the hydrostatic screens. As a result of rapidly accumulating hair, the pig receiving port was removed during the facility start-up process. If the operator chooses to launch the pig from the V2 vault, a 6-inch foam pig is to be used. At least one influent pump must be operable. The operator will turn off the pump, install the pig in the launching port, turn the pumps back on to automatic operation, and swing the pig into launch position. When the pump pushes the pig to the headworks, the operator is to turn the influent pump station back to "off", open the flange plate at the headworks, and retrieve the pig. The flange place would then be replaced, and the influent lift station returned to normal operations.

6.3.3 Emergency Bypass

To bypass the headworks, the operator must first assure that the gasketed lid on manhole K-4 is tightly on. The operator is then to close valves 9, 10, and 11, and open valves 7 and 12, sending flow directly from FM-I to the fermenter tank in the extended aeration treatment basins. Bypassing the headworks is not recommended unless it is absolutely necessary because both screens are inoperable.

6.4 AeroMod Extended Aeration Treatment Basins

6.4.1 Background

For detailed information regarding the Operation and Maintenance of the AeroMod Sequox Treatment Processes, please see Volume 3 of the contractor-supplied Operation and Maintenance Manuals.

The Plummer WWTP utilizes the AeroMod Sequox Plus wastewater treatment process for secondary wastewater treatment. The Sequox Plus treatment process optimizes biological nutrient removal and energy efficiency. Continuous flow through the plant is split between two trains. Each train consists of a first-stage aeration tank and a second-stage aeration tank, and is entitled "A" and "B". Plummer's "A" train is on the east side, "B" train is on the west. Air supply from the blowers alternates between the first stage and second stage, so that aeration tanks A1 and B2 are active at the same time, and B1 and A2 are active at the same time.

6.4.2 Process Sequence and Normal Operation

The following sections describe the treatment processes through the flow pattern within the AeroMod.

6.4.2.1 Fermenter Tank

When flow leaves the static screens and enters the extended aeration basins, influent enters the fermenter tank. The fermenter tank promotes anaerobic decomposition of the influent waste stream to encourage the growth of volatile fatty acids (VFA). VFAs are the food required by the organisms that biologically remove the phosphorus from the wastewater. The desired solids retention time (SRT) in this tank is approximately 2 to 3 days, and the tank is not mixed as a result.

6.4.2.2 Anaerobic Tank

From the fermenter tank, the waste stream flows into the anaerobic tank. The anaerobic tank (also known as the selector tank) is the portion of the treatment process where the wastewater is initially mixed with activated sludge. The activated sludge flows from the bottom of the clarifiers into the selector tank via return activated sludge air lifts and the return activated sludge trough. Close to anaerobic conditions are required in this tank to promote the phosphorus uptake and removal by the phosphate accumulating organisms (PAOs). When under anaerobic conditions, the PAOs uptake the VFAs, and use stored phosphates as their oxygen source to incorporate the food. As the PAOs take up the VFAs, they actually release the phosphorus that is split from the oxygen in the phosphates. This portion of released phosphorus is later re-accumulated by the PAOs for future use. The anaerobic (selector) tank is continually mixed by a Landia submersible mixer so that oxygen is not inadvertently introduced into the tank.

6.4.2.3 1st Stage Aeration

From the anaerobic tank, flow splits into the 1st Stage Aeration Tanks of both the "A" and "B" trains. It is the aerobic treatment of the 1st Stage Aeration tanks that removes BOD and ammonia. This 1st stage also provides the oxygen necessary for the PAOs to uptake phosphorus and store it as phosphate. The air supply to the first stage is intended to be sequenced on and off between the "A" and "B" trains. Three 25HP Kaeser Blowers, located in the Mechanical Building's Blower Room, provide up to 454 ICFM, each. The plant is designed so only two blowers run at a single time, with a third available for redundancy. To optimize energy usage, the blowers are variable-frequency driven. Please follow the manufacturer's recommended Operation and Maintenance schedules, which can be found in Volume 3 of the comprehensive contractor-supplied Operation and Maintenance documents. When the air is cycled off, anoxic conditions created by the available food promote the bacterial removal of the nitrates formed by the nitrification of ammonia (denitrification). Generally, dissolved oxygen levels between 0.5 and 2.0 at the end of the aeration cycle are sufficient. The target level is 1.0 mg/L. The aeration cycling is achieved by the use of pneumatically actuated valves on the airlines. These valves are controlled by the SEQ 1 timer and switches in the control panel.

6.4.2.4 2nd Stage Aeration

Following the 1st stage aeration, the 2nd stage completes the aerobic treatment. Air in the second stage is also cycled off and on between the two 2nd stage aeration tanks to promote additional denitrification. When the air is turned off, the mixed liquor settles into a concentrated biomass in the lower third of the tank where it becomes anoxic. Nitrified mixed liquor flows continuously into this zone for denitrification. The alternation of air is controlled pneumatically by the SEQ2 timer and switches in the control panel.

6.4.2.5 Clarification Zone

Flow from the 2nd Stage Aeration tanks enters the clarification zone through the inlet screens and distributor pipes. In the clarification zones, the settleable solids are separated from the MLSS by gravity. The solids are removed and returned to the process (Selector Tank) by the RAS airlifts.

Flow is continuous into and out of the clarifier. The effluent weir sets the minimum water level in the plant. If the influent flow rate exceeds the design flow rate of the orifice in the effluent weir, the water level in the plant will rise, providing about five inches of surge storage in the extended aeration treatment basins.

Floating skimmers remove scum and debris from the surface and return them to the selector tank. The skimmers should be adjusted to minimize the amount of water they remove from the clarifier. This is accomplished by adjusting the skimmer weir in the floating head to maintain a flow depth of one-eighth to three-sixteenths of an inch over the weir. Air flow through the ball valve should be adjusted so that the water level in the throat drops three to four inches, which minimizes the "bounce" of the air skimmers and increases their effectiveness. Generally, once set, the skimmer air flow control ball valves should not need adjusting unless the air skimmers are accidentally impacted during cleaning.

6.4.2.6 Digesters

The purpose of the digesters is to stabilize and store the waste activated sludge from the process until it can be disposed. The wasting process thickens the digester sludge by shutting off the digester air during the wasting cycle to settle the digester solids and allow the wasted mixed liquor solids to also settle out as they are removed. Because the digester is full, clear supernatant will be displaced and returned to the aeration tank over the supernatant return weir.

Regular removal of sludge from the digester is necessary to protect the efficiency of the process. If enough sludge is not removed, digester solids will be carried back to the aeration tanks and will adversely impact the treatment process.

The digester aeration should be sufficiently vigorous to keep the solids in suspension, and maintain the sludge in an aerobic state.

6.4.3 Controls

All AeroMod plant operations are controlled by the RTU Master Control Panel. Aeration alternation, return activated sludge (RAS), and wasting timers activate the pneumatic valves associated with each process.

The compressed air used to operate the pneumatic system is produced by a duplex air compressor (which also runs the BluePRO airlift). The duplex piston-type air compressor, an Ingersoll-Rand Model 2545, is located in the storage room of the operations building. A control panel is supplied to alternate the lead and lag compressor. A regenerative desiccant dryer ensures that no moisture enters the pneumatic system.

Electrically powered devices such as the blowers are controlled by individual panels. The blower motor controls and variable frequency drives are located in the mechanical building blower room.

6.4.3.1 Aeration Valves

The aeration valves are referenced by their respective train and stage: SEQ A1 and SEQ B1 for the first stage, and SEQ A2 and SEQ B2 for the second stage. The panel indicator lights are green for "air on" and red for "air off".

Valves SEQ A1 and SEQ B1 are controlled by the SEQ-1 timer and valves SEQ A2 and SEQ B2 are controlled by the SEQ-2 timer. The air typically cycles between the A and B trains on a two-hour basis. There is an overlap period of one minute when the aeration switches trains to prevent running the blower against a closed valve.

6.4.3.2 Return Activated Sludge (RAS)

Removal and return of activated sludge from the clarifiers is done by a system of suction hoods and airlift pumps. There are two pneumatically operated valves, located at the end of each clarifier bridge, which are controlled by the RAS timer at the control panel. Each valve operates the row of suction hoods and their airlifts adjacent to the side on which the valve is located. When the valve opens, air is drawn from the aeration piping to operate the airlifts, which discharge onto the RAS trough and into the selector tank.

The RAS cycle nomenclature references the Train (A or B) and then sequence number (1 or 2). Each cycle will operate two valves on adjacent clarifier bridges. A single bank of RAS airlifts can be manually operated by placing the ON-OFF-AUTO switch in the ON position. In the OFF setting, the RAS airlifts will not run. In the AUTO setting, the RAS airlifts are controlled by the RAS timer, whereby the operator can control the length of the ON and OFF periods. Typical timer settings are about one minute of run time per five-minute period, for each bank for suction hoods. Concentration and settleability characteristics of the mixed liquor will determine actual timer settings.

6.4.3.3 Wasting Activated Sludge (WAS)

Wasting, or removing sludge from the process, is necessary to control the mass and age of the activated sludge microbial population. The WAS system utilizes a dual function weekly timer to automatically waste to the digester on a daily basis.

There are two parts to the wasting process. Program 1 shuts off the digester air to allow the sludge to settle out, then Program 2 runs the WAS airlift which is timed to remove a certain amount of waste sludge from the aeration tank. Fifteen minutes after the WAS airlift shuts off; Program 1 opens the valve to re-aerate the digester.

BluePro Advanced Phosphorus Removal Filters

6.4.4 Background

Volume 5 of the supplied Operation and Maintenance Manual contains extensive information regarding the BluePRO® phosphorus removal system. For a troubleshooting guide and maintenance schedule, please see this O&M Volume.

From the AeroMod treatment vessel, wastewater then flows to the BluePRO phosphorus removal filters for tertiary phosphorus removal prior to disinfection. The BluePRO® phosphorus removal system employs the method of reactive filtration which utilizes continuous regeneration of reactive filter media. The reactive filter media maximizes the removal efficiency by promoting both adsorption as well as co-precipitation within the filter bed. Each filter is filled with a moving bed of silica sand, which is continuously cleaned as the particles grind against each other, removing the outer layer of each particle and creating fresh sites for adsorption. It is because of this continuous motion that no backwashing or exchange of media is necessary.

For information regarding the headloss gauges and airlifts, please see Volume 5 of the supplied Operation and Maintenance Manual. Each filter is equipped with a headloss gauge and air lift to assist the operator in determining the performance of the filters.

6.4.5 Major Components

The Plummer WWTP Phosphorus Removal Filters (PREM) consist of four filters in two passes that can be run in both series and in parallel. Each filter contains a filter bed depth of 60-inches. See Figure 5 for the general filter arrangement. The filters, Model CF-64 UF, each contain a fiberglass washbox, schedule 80 PVC airlifts, and fiberglass central feed chambers. The PREM influent is measured by a 10-inch magnetic flow meter located in a meter vault on SS Line B, upstream of the 1st pass chemical injection point. The flow meter flow paces the injection of the ferric sulfate, which is used to coat the silica sand to help in the co-precipitation process. The ferric sulfate is stored in two 8,000 gallon above ground fiberglass storage tanks. As of this writing, the City of Plummer has a contract with NALCO Chemical Company for ferric sulfate delivery. The average iron concentration of the ferric sulfate used by the City of Plummer is 12%.

- NALCO Chemical Company Contact Information
    - John Deines :
    - Email: jddeines@nalco.com
    - Phone: 509-928-7713 (office), 509-981-5295 (cell)

A duplex chemical feed system draws from the ferric sulfate tanks and doses the PREM influent prior to the first filter pass and then between the first and second filter passes. This chemical feed system utilizes a Grundfos DME 8-10 digital dosing pump and is located inside the ferric sulfate secondary containment structure within a weather-proof housing. See Volume 5 of the Operation and Maintenance Manual for specific information regarding the regular maintenance of the dosing pumps and their components.

Each filter contains an influent pressure switch transmitter, which relays a signal to the filter control panel. The Control Panel provides the Operator with alarm information and general filter performance. See Volume 5 of the Operation and Maintenance Manual for an in-depth discussion on the filter controls.

Sample pumps located in both the meter vault on SS Line B and in vault V5 draw PREM influent and effluent to the Phosphate Analyzer Skid located in the Operations Building Laboratory. This sample skid reads PREM

Valve Number	Description	Position	Function

influent and effluent ortho-phosphorus concentrations as well as turbidity and pH. This sample skid is to provide the Plummer WWTP operators with a snapshot of filter performance at any given time. Effluent samples from the Plant should still be sent to an accredited lab for low level phosphorus analysis.

6.4.6 Normal Operation

In general, normal operation of the PREM filters requires very little attention from the operator. It should be noted that when plant flows are less than 100,000 GPD, only one filter train should be in operation. The operator should observe flows through the magnetic meter on SS Line B as flows greater than 224 gpm require the use of both filter trains. Volume 5, Section 7 of the Operation and Maintenance Manual provides a troubleshooting guide which is to be used if problems arise during normal operation.

It is imperative that the filter airlifts are running when wastewater is flowing through the filters. If the airlifts are not running, the sand bed will not be cleaned and will eventually become plugged. There must be sufficient reject flow (approximately 14-16 gpm) whenever the filters are running. The reject flow keeps the sand washed; without the reject flow, dirty sand is returned to the top of the filter, preventing proper filter performance.

For normal, dual filter operation up to a total plant influent flow rate of 432,000 GPD, see Table 11 below. Low flow (less than 100,000 GPD), single filter operation is covered in Table 12, and high flow operation without bypass (up to 1.09 MGD) is covered in Table 13. High flow operation with bypass is covered in Table 14.

Table 11- Phosphorus Removal Filter – Normal Operation

Valve Number	Description	Position	Function
13	10" Gate	Closed	Prevents TRMNT and/or PREM flow from bypass UV Disinfection
16	10" Gate	Open	Allows TRMNT Flow to Enter PREM system
17	10" Gate	Closed	Prevents TRMNT Flow from bypass of PREM system
18	10" Gate	Open	Allows TRMNT Flow to Enter 1^{st} Pass A Filter
19	10" Gate	Open	Allows TRMNT Flow to Enter 1^{st} Pass B Filter
20	2" BV	Closed	Prevents 1^{st} Pass A Filter from Draining
21	2" BV	Closed	Prevents 1^{st} Pass B Filter from Draining
22	10" Gate	Open	Allows TRMNT Flow to Enter 2^{nd} Pass A Filter
23	10" Gate	Open	Allows TRMNT Flow to Enter 2^{nd} Pass B Filter
24	2" BV	Closed	Prevents 2^{nd} Pass A Filter from Draining
25	2" BV	Closed	Prevents 2^{nd} Pass B Filter from Draining
27	10" Gate	Open	Allows PREM Effluent to flow to UV Disinfection
28	10" Gate	Open	Allows PREM Effluent to flow to UV Disinfection
29	10" Gate	Closed	Prevents PREM Effluent from bypassing UV Disinfection

13	10" Gate	Closed	Prevents TRMNT and/or PREM flow from bypass UV Disinfection
16	10" Gate	Open	Allows TRMNT Flow to Enter PREM system
17	10" Gate	Closed	Prevents TRMNT Flow from bypass of PREM system
18	10" Gate	Open	Allows TRMNT Flow to Enter 1st Pass Filter
19	10" Gate	Closed	Prevents TRMNT Flow to Enter 1st Pass Filter
20	2" BV	Closed	Prevents Filter from Draining
21	2" BV	Closed	Prevents Filter from Draining
22	10" Gate	Open	Allows TRMNT Flow to Enter 2nd Pass Filter
23	10" Gate	Closed	Prevents TRMNT Flow to Enter 2nd Pass Filter
24	2" BV	Closed	Prevents Filter from Draining
25	2" BV	Closed	Prevents Filter from Draining
27	10" Gate	Open	Allows PREM Effluent to flow to UV Disinfection
28	10" Gate	Open	Allows PREM Effluent to flow to UV Disinfection
29	10" Gate	Closed	Prevents PREM Effluent from bypassing UV Disinfection

Table 12 - Phosphorus Removal Filter – Low Flow Operation

6.4.7 High Flow Operation and Bypass

<u>High Flow During Normal Operating Hours:</u> Should the operator see influent flow rates climb above 300 gpm at any time, and external conditions (rainfall and/or snow melt) indicate that high flows are likely to continue to increase flow rates to the facility, the operator will initiate a bypass of the BluePRO® system. Plummer's filters are CF-64s, with a nominal rated capacity of 224 gpm for each filter. However, for sustained high flow, USKH recommends that after four hours at a flow rate higher than 150 gpm per filter train, bypass of the Blue Pro filters be initiated.

A. For flow rates between 300 gpm and 759 gpm:

Keeping the BluePRO® system in operation, <u>first</u> close valve 13 to prevent bypass of the UV disinfection system. Keep valves 16 (on B line) and 27 and 28 (both on C line) open. Open valve 29 in the V5 vault to allow flow between the E line and C line. Then, and only then, slowly open valve 17 to allow flow into the E-line, while maintaining flow to the BluePRO® system. This will require coordination between the person opening valve 17 and someone observing operation of the BluePRO® system to assure it continues to receive flow. Flow pacing of the ferric sulfate dose will not work, as flow through the B-line flow meter will be higher than actual flow through the BluePRO® filters. As a result, the operator will have to manually re-adjust the ferric sulfate dose using the BluePRO® control panel and the controls for the Grundfos dosing pumps. The operator is to consult Volume 5 of the Contractor-supplied operations and maintenance manuals for the correct manual dosing procedure.

B. For flow rates between 759 gpm and 833 gpm:

As 833 gpm is the design hydraulic limit that the plant was designed for, this is the maximum hydraulic capacity of the entire system. In this circumstance, the City has four options:

1. First, it is theoretically possible to continue to balance flow through the E-line bypass, back into the C-line, and also through the BluePRO® system as in scenario A above. The hydraulic capacity of the UV banks is 1.2 mgd (833 gpm), so all flow can still be disinfected. The hydraulic capacity of LS2 and the effluent force main is also 833 gpm. However, it will be very important for the operator to maintain a continuous balance of the valving between the E-line bypass and the BluePRO® filters. As this scenario would be labor intensive, this approach is not recommended above flows greater than 759 gpm.

2. Second, all flow can be diverted through the E-line, and the BluePro filters can be shut off by closing valves 16 and 27. All other valve positions described under scenario A above can be maintained for this scenario, B.2. This continues to allow disinfection to proceed, though disinfection may be less effective, as it is likely that turbidity in the treated wastewater will be significantly higher than it is from BluePRO® filtered treated wastewater.

3. Third, all flow can be diverted through the E-line, the BluePRO® filters shut off by closing valve 16, and bypass of the UV disinfection system initiated by first opening valve 13 and then closing valve 29 in the V5 vault. This option should only be implemented if the UV disinfection system is failing or is in danger of failing because of high turbidity and solids in the effluent from the AeroMod system in the B-line. It is recommend that valves 27 and 28 be left open until residual from the BluePRO® filters has drained through the UV system.

Fourth, a portion of flow can be diverted to a portion of the old lagoon system as long as there is storage available. After the high flow emergency is over, liquid stored in the old lagoon(s) can be pumped back over to LS1 for normal treatment and discharge through the City's treatment facility. If the old lagoon system is no longer available, the only option left is for the City if flows are greater than 833 gpm, is to bypass treatment of some of the influent flow by opening the gate valve on the old pipe to the lagoons, located east of the shallow terminus manhole of the collection system, and allowing as small a stream as possible (maintaining flow to LS1 in the meantime) to enter Plummer Creek at the culvert end south of and upstream of the LS1 site.

High Flow Outside of Normal Operating Hours: The operator on duty will be alerted by the auto-dialer that the float switch in the second stage aeration tank of B-train of the AeroMod subsystem has reached the alarm level. The operator will then immediately get to the treatment facility and examine the level in the AeroMod tanks and the BluePro filters. The operator will then look back at the SCADA system flow readouts for the period since leaving the plant to determine the flow trends. If flow trends and weather indicate continued high flow, the operator will call for a backup person to help operate the plant on an emergency basis in accordance with the options A or B outlined above. Should the operator determine that the flows are on their way back to normal range, before leaving the plant site again, the operator will visually check the UV room and grounds for further evidence.

Table 13- Phosphorus Removal Filter – High Flow Operation, Partial Bypass

Valve Number	Description	Position	Function
13	10" Gate	Closed	Prevents flow from bypassing UV Disinfection
16	10" Gate	Open	Allows TRMNT Flow to Enter PREM system
17	10" Gate	Part Open	Allows some TRMNT Flow to bypass PREM system
18	10" Gate	Open	Allows TRMNT Flow to Enter 1st Pass Filter
19	10" Gate	Closed	Prevents TRMNT Flow to Enter 1st Pass Filter
20	2" BV	Closed	Prevents Filter from Draining
21	2" BV	Closed	Prevents Filter from Draining
22	10" Gate	Open	Allows TRMNT Flow to Enter 2nd Pass Filter
23	10" Gate	Closed	Prevents TRMNT Flow to Enter 2nd Pass Filter
24	2" BV	Closed	Prevents Filter from Draining
25	2" BV	Closed	Prevents Filter from Draining
27	10" Gate	Open	Allows PREM Effluent to flow to UV Disinfection
28	10" Gate	Open	Allows PREM Effluent to flow to UV Disinfection
29	10" Gate	Open	Allows bypass of PREM to flow to UV Disinfection

Table 14- Phosphorus Removal Filter – High Flow Operation, Total Bypass

Valve Number	Description	Position	Function
13	10" Gate	Closed	Prevents TRMNT flow from bypass UV Disinfection
16	10" Gate	Closed	PreventsTRMNT Flow to PREM system
17	10" Gate	Open	Allows TRMNT Flow to bypass PREM system
18	10" Gate	NA	Allows TRMNT Flow to Enter 1st Pass Filter
19	10" Gate	NA	Prevents TRMNT Flow to Enter 1st Pass Filter
20	2" BV	Closed	Prevents Filter from Draining
21	2" BV	Closed	Prevents Filter from Draining
22	10" Gate	NA	Allows TRMNT Flow to Enter 2nd Pass Filter
23	10" Gate	NA	Prevents TRMNT Flow to Enter 2nd Pass Filter
24	2" BV	Closed	Prevents Filter from Draining
25	2" BV	Closed	Prevents Filter from Draining
27	10" Gate	Closed	Prevents TRMNT flow from backing into PREM system
28	10" Gate	Open	Allows TRMNT flow to UV Disinfection
29	10" Gate	Closed	Prevents TRMNT flow from bypassing UV Disinfection

6.5 Ultraviolet Disinfection System

6.5.1 Background

Ultraviolet (UV) disinfection uses ultraviolet light to disinfect wastewater. UV light is defined as electromagnetic radiation having a wavelength less than that of visible light (400 nanometers), and greater than that of x-rays (100 nanometers). UV light at 254 nanometers has been found to be effective at wastewater disinfection. UV light is produced by exciting mercury vapor within a lamp. UV light causes rearrangement (mutation) in the genetic code of the microorganisms present in the clarified effluent. However, the effectiveness of the UV disinfection process depends on the UV radiation reaching the microorganisms. Visible and invisible particles in the wastewater can shield the microorganisms from exposure to UV radiation, resulting in longer exposure times necessary to deliver the proper UV dose. The UV disinfection system follows the BluePRO advanced phosphorus removal systems, which will aid in the additional removal of suspended solids, decreasing turbidity, and thus increasing the effective UV radiation reaching microorganisms.

6.5.2 Major Components

The Infilco Degremont UV disinfection system consists of three Auqaray™ HLS (Model 40-LH) horizontal toughs that can be operated in series flow (normal flow) or in a parallel flow, if desired. The major system components are shown in Figure 6 and include the following:

1. Three disinfection troughs (2 duty, 1 redundant) each contain 40 horizontally arrayed lamps, lamp sleeves, ballasts, and electrical components for the monitoring, control, and data storage of the disinfection process. The facility has been constructed so that three additional troughs can be added in the future.

2. Lamp Assembly – Each of the low-pressure UV lamps produces UV light with at least 90% of the UV emission at 253.7 nanometer wavelength and will produce no less than 80% of the original output at 8,670 hours of operation. A Type 214 quartz jacket protects each UV lamp from direct contact with the wastewater. These quartz jackets allow a minimum of 90% transmittance through the jacket at 253.7 nanometers.

3. Monitoring System- Each channel is equipped with a UV intensity sensor that responds to the germicidal portion of light generated. The intensity sensor is connected to the monitoring system that uses an LCD bar graph on a remote control panel indicating "safe", "low", "fail" and "failure alarm" intensity conditions. The running total of lamp hours will also be displayed. The control panel for the UV system has a NEMA 4x enclosure and is equipped with an on-off switch for activation of the intensity monitoring system and elapsed time indicator.

4. Cleaning Station – The UV disinfection system includes a cleaning rack that allows each lamp module to be securely held while the lamps are cleaned with a citric acid solution. This solution is used to remove mineral deposits, scum, and algae that may build up on the outside of the lamp sleeves during normal operation.

6.5.3 Normal Operation

Under normal operation (series) flow conditions, effluent from the advanced phosphorus removal filtration system enters the first of two UV disinfection channels (as one is reserved for redundancy) within the Mechanical building and disinfection occurs as the wastewater flows from one channel into the other, passing by the 80 UV lamps within the two banks. During peak flow, the UV system will provide a minimum contact time of 22.78 seconds and have an 11-inch internal weir to regulate the water level. This normal flow configuration and valve settings are shown in Figure 7 – UV Channel. Table 15 below lists the valves and their positions needed for proper UV disinfection process control.

Table 15 – **UV Disinfection Valve Position – Normal Operation**

Valve Number	Description	Position	Function
28	10" Gate	Open	Allows PREM Effluent to Flow to UV
29	10" Gate	Closed	Prevents flow from entering bypass
30	12" Gate	Open	Allows flow to enter Bank 1
34	12" Gate	Closed	Prevents bypass of UV system
36	12" Gate	Open	Allows flow to leave Bank 2
32	12" Gate	Closed	Prevents flow from entering/leaving Bank 3
38	12" Gate	Closed	Prevents flow from entering/leaving Bank 3
40	12" Gate	Open	Allows flow from Bank 2 to flow to LS-2

It should be noted that Bank 3 is a redundant bank, only to be used when Bank 1 or Bank 2 is offline. Valves 28, 32, 38 and 40 should be opened when Bank 3 is in use.

The UV disinfection system must be online and functioning properly whenever there is wastewater flowing through the disinfection channels. Any interruption of operation will result in loss of disinfection. Normally the system should be operated in the fully automatic position, which will ensure that the appropriate number of modules necessary to fully disinfect the volume of wastewater flowing through the channel is operating.

During periodic maintenance, it may be necessary to remove a disinfection channel from service. Before removing a channel from operation, the standby disinfection unit must be brought online and properly disinfected with a chlorine solution. For detailed instructions for manual activation of individual UV disinfection channels, the operator should refer to the UV disinfection Operation and Maintenance Manual provided by the manufacturer.

The UV disinfection system is fully automatic. After performing the initial start-up procedure, the system will require only limited attention. Initial start up procedure, as outlined by the manufacturer's Operation and Maintenance Manual is as follows:

- Prior to allowing flow to enter the channel, verify:
    - Control panel is installed properly and "ON-OFF" switch is in the "ON" position.
    - The UV intensity monitor should indicate satisfactory condition.
    - All "red" ballast enclosure lights should be illuminated
    - The equipment load circuit interrupters (ELCI) should be set and operating.
        - If all of these conditions are met, proceed with startup. If a condition is not met, turn "OFF" the "ON-OFF" switch, cut off power to the ballast enclosures and recheck all wiring connections. Verify the system before proceeding.

- During wet startup and anytime downstream piping is modified, the piping needs to be disinfected. Disinfect the pipe by adding a chlorine solution containing 100 mg/L of chlorine into the module's channel. The chlorine solution should be allowed to flow until a chlorine odor is detected at a sample point downstream of the UV system. Close the downstream valve that will cause the chlorine solution to fill the piping below the UV unit. Allow the chlorine solution to remain in the piping for a minimum of three (3) hours. Drain the chlorine solution.
- Following disinfection downstream, and with the system controls "ON", fill the channel with clean water (groundwater is acceptable here) slowly to prevent damage to the quartz jackets. Once the water level crests above the weir, it will begin to flow out of the module and the system is in operation.
- The use of potable water during start-up of the UV disinfection system is acceptable, however the UV intensity meter will probably not read in the "SAFE" region at first, once effluent enters the channel, the readings should come up normal.

6.5.4 System Cleaning

The UV lamp quartz jackets need to be cleaned occasionally to remove the build up that forms on the surface from the wastewater. When the UV intensity meter indicates a "Low" reading, the jackets will need to be cleaned. In order to clean the jackets, do the following:

1. Disconnect the power to the module to be cleaned. Removed the module from the channel and place module on the cleaning rack.

2. Use hydrated food grade citric acid and a Scotch-Brite™ cleaning pad to remove any residue coating of calcium carbonate (generally a white coating). If a reddish coating is observed, Rust-Away may be necessary to remove the iron build up. Use of these products will not scratch the quartz jackets.

3. Clean the photocell by soaking in "Lime Away" or Zep "Acidic Toilet Bowl Cleaner" for at least 30 minutes. First remove the stainless steel clip which holds the photocell on the quartz jackets by removing the 2 Phillips-head screws. Rinse the photocell after soaking. The Photocell Teflon eye (between the prongs, the size of a dime) should be bright white after soaking. If it is not, return the photocell to soak again up to a period of 3 hours.

4. Once the quartz jackets dry clear, reinstall the UV lamp module and return the unit to service.

6.5.5 Light Installation and Replacement

Care needs to be taken when replacing the UV lamps within the lamp modules. The operator is directed to the UV Disinfection Operation and Maintenance Manual for detailed instructions regarding the lamp installation.

6.5.6 Local Operator Interface Panel

The Local Operator Interface Panel is the control and monitoring station for the UV disinfection system. The operator is referred to the UV Disinfection Operation and Maintenance Manual for detailed information regarding this panel.

6.5.7 Bypass

There are two means of bypassing UV disinfection, interior and exterior to the Mechanical Building. Bypass should only be undertaken during extreme circumstances, as inactivation of fecal coliform bacteria is one of the primary functions of the treatment facility. To initiate bypass, the operator is referred to the Contractor-supplied O&M manual Volume 1, Section 13004 for the safe shut-down of the affected UV disinfection channels. Once this procedure is accessed, the operator will coordinate electrical and controls shut down with valve closures. The operator is to follow the valve closures shown in Tables 16 and 17 below. Table 16 shows the bypass procedure necessary to bypass internally to the Mechanical Building. This is the recommend procedure. However, in the event the entire building must be bypassed, Table 17 details the valve positions necessary to accomplish that.

Table 16– **UV Disinfection Valve Position – Bypass Option 1**

Valve Number	Description	Position	Function
28	10" Gate	Open	Allows PREM Effluent to Flow to UV
29	10" Gate	Closed	Prevents flow from entering bypass
30	12" Gate	Closed	Prevents flow to Bank 1
34	12" Gate	Open	Allows bypass of UV system
36	12" Gate	NA	Controls flow exiting Bank 2
32	12" Gate	Closed	Prevents flow from entering/leaving Bank 3
38	12" Gate	NA	Prevents flow from entering/leaving Bank 3
40	12" Gate	Closed	Prevents flow from entering back of UV units

Table 17– **UV Disinfection Valve Position – Bypass Option 2**

Valve Number	Description	Position	Function
28	10" Gate	Closed	Prevents PREM Effluent from flow to UV
29	10" Gate	Open	Allows flow to enter bypass
30	12" Gate	NA	Controls flow to Bank 1
34	12" Gate	Closed	Prevents flow out of UV room
36	12" Gate	NA	Controls flow exiting Bank 2
32	12" Gate	NA	Prevents flow from entering/leaving Bank 3
38	12" Gate	NA	Prevents flow from entering/leaving Bank 3
40	12" Gate	Closed	Prevents flow from entering back of UV units
44	10" Gate	Open	Allows flow from the bypass to enter LS2

6.6 Effluent Lift Station and Discharge

6.6.1 Background

The effluent lift station receives wastewater from the UV disinfection troughs via a 10-inch DI process line. The internal dimensions of the rectangular reinforced concrete wet well are 23-feet long x 12-feet wide x 8-feet deep. The submersible pumps sit in a 4.5-foot deep sump that is 4 feet wide and 7-feet 4-inches long. The wet well is located south of the Mechanical Building's covered sludge storage area easement and is completely underground, accessible via a manhole lid. The controls for the lift station are located in LCP-1 and the motor control center "A" inside the blower room of the Mechanical Building.

Wastewater enters the effluent lift station, where one or both of the identical pumps lift the wastewater to the effluent discharge area, located approximately 4,438 feet to the south west. Both pumps are American Marsh (Model 8KC) vertical turbine pumps with a capacity of 417 gpm at a total dynamic head of 257 feet. The pumps are driven by 40 horsepower motors, operating on 460 volt, 3 phase current and are equipped with variable frequency drives.

Control of the start-stop operation of the two pumps is automatic and controlled by a pressure transducer/level system. The variable speed drives are designed to match pump capacity with the incoming flow of wastewater to the wet well and pump that quantity to the effluent discharge area. If one of the two pumps is taken out of service, the remaining pump has the capacity to accommodate the peak design flow. The effluent lift station, like the rest of the treatment plant, is connected to an onsite stand by generator. In the event of a utility power outage power will be supplied to the influent pumps via the stand by generation system. As an additional safety factor, the wet well has additional capacity to store several hours of incoming wastewater during a prolonged power outage.

6.6.2 Normal Operation

The variable speed pumps are controlled by pressure transducers, which sense the water surface elevation within the wet well, and a pump control panel which regulates the speed of the pumps to match the incoming flow. The pump controls are tied into the programmable logic controller which translates a signal to turn the pumps on or off based on the liquid level within the wet well. The pump controls are located in the LCP-1 panel system and tie back into the motor control center, all located within the blower room of the Mechanical Building.

Under normal operating circumstances, the two pumps operate automatically based on the water surface elevation sensed by the pressure transducer. As the disinfected wastewater enters the effluent lift station wet well, LS-2, the internal water level rises until it reaches the normal operating level. Once this liquid level is reached, the lead pump slowly starts, speeding up to balance the inflow and the pump capacity, allowing the water level to remain steady. Even with slight changes in the water level, the pump speed changes to maintain the equilibrium between the pump capacity and influent flow. If the flow into the wet well drops off and falls below the pumps minimum capacity, the low level setting is reached and the pump shuts off.

The second pump within the wet well is for redundancy if the lead pump ever needs to be taken off line or malfunctions. The peak pump capacity of each individual pump is identical to the peak Phase I flow of 0.630 MGD, or 417 gpm. The second pump will be controlled automatically, identically to the lead pump. The pump operation will be cycled to prevent the solitary usage of a single pump. Should the liquid level within the wet well continue to rise, due to higher than normal flows or due to a pump failure, the high water alarm level will be reached, signaling the attention of the operator on duty. See the table below for a description of the operational settings for the effluent pumps.

Table 18 – **Effluent Lift Station (LS-2 Pump and Operational Settings**

Operation Level	Operational Setting, feet MSL
High Level Alarm	2655.46
High Level of Normal Range	2655.21
Normal Operating Level	2650.71
Low Level Alarm	2650.21

Figure 8 – Effluent Lift Station shows the vaults and valves used to control the inflow to the wet well. See the table below for a normal LS-2 operation valve guide.

Table 19 – **Effluent Lift Station (LS-2) Valve Position – Normal Operation**

Valve Number	Description	Position	Function
43	10" Gate	Open	Allows UV effluent to flow into wet well
45	6" Gate	Open	Allows sewage to flow into FM-I from Pump No. 1
45*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off
46	6" Gate	Open	Allows sewage to flow into FM-I from Pump No. 2
46*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off

Each individual pump discharge line is equipped with an isolation valve so each pump can be isolated and removed from service without having to shut down LS-2 operation. Assuming all valves are positioned for normal operation, the valve positions shown below in Table 20 should be followed to take Pump No. 1 out of service.

Table 20 - **Effluent Lift Station (LS-2) Valve Position – Pump No. 1 Out of Service**

Valve Number	Description	Position	Function
43	10" Gate	Open	Allows UV effluent to flow into wet well
45	6" Gate	Closed	Prevents sewage to flow into FM-E from Pump No. 1
45*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off
46	6" Gate	Open	Allows sewage to flow into FM-E from Pump No. 2
46*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off

Assuming normal operation, the valve positions shown below in Table 21 should be followed to take Pump No. 2 out of service.

Table 21 - **Effluent Lift Station (LS-2) Valve Position – Pump No. 2 Out of Service**

Valve Number	Description	Position	Function
43	10" Gate	Open	Allows UV effluent to flow into wet well
45	6" Gate	Open	Allows sewage to flow into FM-E from Pump No. 1
45*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off
46	6" Gate	Closed	Prevents sewage to flow into FM-E from Pump No. 2
46*	6" Check		Prevents sewage from flowing backwards into the wet well following pump shut off

The pumps individually discharge into a 6-inch pipe that is connected to a 6-inch common header and 6-inch discharge pipe that carries the wastewater to the effluent discharge area. In order to modify or repair the header, the operator should ensure that there is sufficient storage within the effluent wet well or that emergency bypass provisions have been made. The effluent forcemain to the effluent discharge area can be drained by turning off all pumps and opening the check valves, allowing the effluent to flow back into the effluent wet well. The discharge lines of each pump should then be closed while repairs are being performed.

Cleaning of the effluent wet well should executed on a regular basis and the sump should be checked for debris accumulation. This wet well should not be plagued with similar grit and debris buildup (as expected in LS-1) as it will be pumping treated effluent to the discharge area. The pump control elevations should also be checked periodically by physically measuring the water level in the wet well. Valves associated with the pump discharge should be exercised monthly to prevent the valve from freezing.

Several problems could affect the performance of the pumps, including plugging of the pump impeller, cavitation or excessive vibration, and electrical malfunction. The manufacturer's recommendations for problem diagnosis and associated maintenance requirements should be consulted by the operator when unsure of the necessary corrective action.

6.6.3 Electrical Controls

The 480 volt, 3 phase, electrical power for the effluent lift station is provided by existing above ground power and is routed through a 15 KVA transformer to step down the voltage in order to feed lower voltage circuits. Normal shut-off and control of each pump is located inside of the MCC "A", part of the control panel array along the east wall of the blower room inside of the Mechanical Building.

The Effluent Lift Station Control Panel provides the features for control (speed, start-stop) of the two effluent pumps based on a signal from the pressure transducer. The transducer provides a signal for the selection of the lead and standby pump and helps trigger lift station alarms. A programmable logic controller (PLC) provides the control functions, and an uninterruptable power supply is included to provide power to the PLC during power outages. Water levels used for pump operation (see Table 18) are programmed into the PLC. The face of the panel shows alarms for PLC fail and high wet well level, which can be acknowledged by pressing the "reset" button on the panel. Both the lead and standby pump can be selected. By selecting a pump for "lead" operation, that pump will start when a signal is received indicating the water level within the wet well has reached the level programmed to start the pump. By selecting a pump as "standby", that pump will be the last pump to start when the wet well level continues to rise to the point where a third pump is needed to keep up with incoming flow. It is important the lead and standby pump selectors are not set to the same pump. Alternating the lead and standby pump will allow the running hours on the pumps to be somewhat equal, which will help increase the longevity of the system.

Each of the two effluent pumps is equipped with a variable frequency drive (VFD). The purpose of the VFD is to pace the motor speed based on the incoming flow rate and corresponding water level within the wet well. . The VFDs act as the motor starters for the pumps and can be programmed through the keypad on the face of the local control panel, LCP-1. Switches are provided for HOA, start, stop, and VFD/Bypass selection and a disconnect for the bypass main and VFD main are provided. In the event of a VFD failure, the panels include the ability to bypass the VFD and operate the pump at full speed using the available line voltage. While the pump would continue to operate, the motor speed and pump capacity would not change as the water level in the wet well varied.

Under normal operation, the operator would select the lead and standby pumps on the Pump Control Panel. Each VFD would be set to "VFD" on the VFD/Bypass selection switch, with the HOA switch set to "Auto". The lift station would run automatically, using the pressure transducers to sense wet well levels, and the pump speed changing as needed to match incoming flows.

If the VFD component is not functioning, then the speed control component can be bypassed by setting the VFD/Bypass selector switch to "Bypass". When the HOA switch is in "Auto", the pump would then start when called by the control panel and run at full speed until signaled to stop (water surface elevation reaches the pump off level). To operate in manual mode, the HOA switch would be set to "Hand", and the operator can start and stop the pump using the "Start" and "Stop" buttons on the face of the VFD panel. The VFDs have other features that allow manual operation of the drives using the VFD keypad, such as placing the drive in "local" mode and changing the speed using the up and down arrow keys. The operator is referred to the VFD manual for operation of the devices. The operator should read the run time hours for each pump on a daily basis, and should keep an up to date log.

6.7 Effluent Discharge and Reuse

LS-2 lifts the treated effluent, via 4,438 LF of 6-inch C900 CL200 force main to the effluent discharge area, located adjacent to Plummer Creek. The rock filter bed discharge area consists of 260 LF of 6-inch PVC that is perforated on the top half by ¼" diameter holes. Orifice shields protect each of the openings from being plugged by the gravel that has been backfilled over the top. As the effluent is pumped from LS-2, the subsurface discharge area provides a final polishing prior to the effluent diffusing into Plummer Creek.

An effluent storage tank, T-1, connects to SS Line D between the UV disinfection system outlet and the effluent lift station. The precast effluent storage tank is 8-feet in diameter and is 14 feet deep. T-1 is connected to SS Line D by a 12x6 reducing tee and normally fills as effluent leaves the UV disinfection troughs and enters the effluent lift station. The 6-inch invert of the 12x6 reducing tee is 3-inches higher than the invert of the 12-inch portion, preventing natural flow into T-1 during periods of low flow. During periods of low flow (<100,000 gpd), the 12-inch gate valve (#43) at the inlet of the effluent lift station (LS-2) must be throttled back slightly to allow the effluent level in the pipe to reach a point where it can naturally flow into T-1. It is recommended that this valve not be left throttled overnight as influent flows tend to peak in the morning.

Within T-1, an Orenco High Head Effluent Pump, Model PF30053200, draws treated effluent out of the tank and charges the belt filter press washwater system within the belt filter press room. This pump also provides the source water for the plant's irrigation system.

6.8 Sludge Dewatering

Sludge that is wasted from the clarifiers within the AeroMod extended aeration basin is routed to the aerobic digesters. From the aerobic digesters, the sludge is pumped to the sludge room within the Mechanical Building. The sludge room houses a sludge pump, 0.8 M Tritan Belt Filter Press, polymer feed system, a cake pump, and controls.

6.8.1 Sludge Pump

The sludge pump, a Seepex Model 30-6LT60LL, is a progressive cavity pump that draws the wasted sludge from the AeroMod system aerobic digesters to the Mechanical Building, approximately 187 LF away. Sludge is dosed with polymer (see Section 6.8.2), mixed and is then pumped to the belt filter press. For specific information on the components and the operation and maintenance of this pump, please see the Manufacturer's Operation and Maintenance Manual included in Volume 4 of the Contractor-supplied O&M manuals.

6.8.2 Polymer Feed System

In sludge dewatering, polymer addition is a key component for binding up the solids and improving water removal. The primary components of the polymer system include the liquid feed polymer unit (with pump), polymer and a waster source. The polymer feed unit is manufactured by Acrison (Model 580) of Moonachie, New Jersey. The system is designed to automatically mix liquid polymer with water at the proper concentration and meter the injection of polymer into the sludge feed line. The quantity of polymer that is diluted and mixed with the water is controlled by a metering pump and the dispersion injector. The polymer is injected into the sludge feed line through a motorized activation chamber. The sludge consistency should be checked initially, to verify the proper quantity of polymer is being added. After initial start up, the process is automatic.

Detailed operation and maintenance of the polymer feed system is included in the manufacturer's manual. The operator is directed to the manufacturer's manual for specific information related to the polymer feed system. Figure 9 shows the location of the polymer feed system and other components located within the Mechanical Building's Sludge Dewatering Room.

6.8.3 Belt Filter Press

The Tritan belt filter press is able to dewater the sludge coming from the aerobic digester of the AeroMod treatment process. The 0.8 meter belt filter press is designed for a maximum solids feed rate of approximately 250 pounds (dry weight) of solids per hour. The sludge after being drawn from the aerobic digesters is dosed with a polymer to help with flocculation. Following the polymer injection, waste sludge is pumped to an AeroMod Tritan Belt Filter Press (Model NP08) for dewatering. It is anticipated that the belt filter press, at a maximum wasting rate of 2,578 gallons per week, will need to operate for approximately 2-1/2 hours per week.

The sludge enters the Tritan through the top of the machine (the pre-thickener), while the dried sludge cake is discharged at the lower part of the machine, or the sludge press. The filtrate water is discharged to the bottom of the machine and exits through a large 6-inch diameter stainless steel pipe that drains to the floor drain, ultimately being recycled back to the influent lift station. After dewatering, the sludge cake is forced up the 6-inch solids discharge chute into the trailer located under the covered sludge storage area. See Section 6.9 for information regarding the biosolids land application.

The Tritan belt filter press is equipped with a control panel for operation of all the machine's functions. The control panel has an emergency stopping device and a PLC that is able to identify problems that may occur with the belt filter press and other associated equipment. While in operation, the belt filter press does not need to be continuously manned, but it is recommended that the equipment be in sight at all times.

The operation of the belt filter press is detailed in the manufacturer's manual, which is in Volume 4 of the Contractor-supplied O&M manuals. This separate document also details the start-up procedures, maintenance activities, and troubleshooting of the belt filter press system. The operator should consult the manufacturer's manual for specific information.

6.9 Biosolids Land Application

A method for beneficial reuse of biosolids is application on agricultural land. The City of Plummer has permitted access to a 40-acre parcel located about 1,600 LF north of the treatment plant site. The site has been approved by the Idaho Department of Environmental Quality. This reuse option provides the only method approved for removing the waste activated sludge from the Plummer wastewater treatment process. A biosolids application plan was prepared following IDAPA 58.014.16.650 to address sludge management once the Class B biosolids are removed from the aerobic digesters.

Upon removal of the biosolids from the aerobic digesters, the sludge (roughly 1.5% solid) will be dewatered by the belt filter press to reach a consistency of 16%-20% solids. From the belt filter press, the sludge will initially be placed in a trailer beneath the covered sludge storage area. From this storage area, the sludge will be hauled to the 40-acre parcel and spread on the topsoil with a conventional manure spreader. An additional sludge storage pad on the 40-acre parcel will allow excess sludge to be stored between times of land application. The available 27 acres of the 40-acre parcel is a large enough area to allow an application rotation, preventing a sludge or toxic material build up in one area. Access to the application area is to be restricted for 30 days following any biosolids application.

The signs required for access restriction must contain the following information:

- The name and address or phone number of the City of Plummer and if different, the person who applied the biosolids to the land;
- The names, addresses and phone numbers of the regulatory and permitting authorities;
- The material that is being applied (e.g., ATTN: BIOSOLIDS APPLICATION); and
- Notice that access is restricted, and if desired, the date after which access is no longer restricted.

The existing field plantings of alfalfa and orchard grass, which yield 3 tons per acre, were tested and calculations determined that these plants are able to take up approximately 124 pounds of nitrogen per acre. This is equivalent to 37 dry tons of total solids per acre, which is more than adequate to uptake the estimated loading of 57 dry tons of solids wasted by the digesters per year.

Frequent monitoring of the land application area is required for compliance with the biosolids application permit. Prior to application, biosolids are to be sampled for all 40 CFR Part 503 metals and nutrients. This assay should be compared to the projected concentrations, and the application rate should be adjusted proportionately to the limiting parameter to ensure over-application does not occur.

The ceiling concentrations, per 40 CFR Part 503, are listed in the table below.

Table 22-**Concentration Limits – Land Applied Biosolids**

Pollutant	Ceiling Concentration Limits Land Applied Biosolids, mg/kg
Arsenic	75
Cadmium	85
Chromium	3,000
Copper	4,300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7,500

6.10 Standby Electrical Generator

The wastewater treatment plant's major components are connected to an auxiliary power supply located north of the Mechanical Building and west of the phosphorus removal filters. In the event of a utility power failure, the standby generator will automatically come online and power the facility. The standby power unit is a 400 kilowatt generator, driven by a diesel engine. The generator's 2,000 gallon fuel supply is located in a base mounted tank and is capable of powering 100% power output for 24 hours.

The standby generator is fully automatic and is supplied with an automatic electrical transfer switch that transfers the plant's electrical components from the normal power supply (City of Plummer) to the standby generator. In the event of a power failure and after a preset time delay, the standby generator automatically starts and remains in operation until the normal power supply is restored. The transfer switch responsible for switching the normal power supply to the generator is located in the motor control center (MCC) located within the blower room of the Mechanical Building. The time delays are built into the standby generation system to provide a factor of safety and prevent the transfer of power in a short term power outage.

The standby generator comes on-line at 1,800 rpm and stays at 1,800 rpm during operation. Following normal restoration of power, the standby unit will be delayed by an adjustable time delay, and the unit will run unloaded until the engine is cool. A time delay is also provided to delay re-transfer from standby to normal power in order to permit stabilization of the normal power source before re-transfer. The control system is designed so that the standby generator and the normal power supply cannot simultaneously operate the components of the wastewater treatment plant.

The standby power unit is equipped with its own HOA switch so that it can be brought both on and off line. The transfer switch has a test switch so that the standby power unit can be operated for testing purposes when there is normal power to the treatment plant. The standby generator is cooled with a solution of 50% ethyleneglycol based antifreeze and 50% water and is furnished with a high temperature safety switch to stop the engine before it can overheat.

The standby generation system is equipped to operate the entire treatment plant in the event of a power outage. All treatment plant processes will be transferred to standby power after a short time delay once the transfer switch activates the generator.

7 LABORATORY TESTING

7.1 General

The laboratory testing equipment available in the lab located within the operations building provides basic tests to help determine compliance with effluent discharge requirements. Testing results produce a practical record of the treatment plant's removal efficiency and aid in predicting problems that may develop within the treatment processes. Following a testing regimen and review of results will help operators take corrective action if one piece of the plant is not functioning properly. The Environmental Protection Agency may also evaluates laboratory test results as a record of the plant's performance to determine if the treatment plant is being properly operated in the event there is a question of compliance with the effluent discharge standards as specified in the City's NPDES permit. However, it is important to note that at the time of this writing, tests for permit compliance are performed in a accredited lab off-site by a third party laboratory. It is important that all tests conducted in the on-site laboratory follow established standards, and that the data reported is complete and accurate. The City has elected to forego Biochemical Oxygen Demand tests. Due to the extremely low concentrations, total phosphorus concentrations will also be measured only off-site. Samples for total phosphorus concentration analysis will need to be sent to a regional certified analytical laboratory for an accurate analysis.

7.2 Sampling Procedures

The objective of sampling is to collect a portion of wastewater or sludge which is small enough in volume to be conveniently handled in the laboratory, yet still an effective representation of the material being examined. The following is a list of general guidelines that should be followed when sampling wastewater or sludge.

1. Take the sample at a point where the wastewater or sludge is well mixed.

2. Exclude large particles that are greater than ¼-inch in diameter in wastewater samples.

3. Do not include deposits, growths, or floating materials that have accumulated at the sampling point. These foreign materials do not give a characteristic profile of wastewater.

4. Examine the collected samples as soon as possible. Any samples that are held for more than an hour should be cooled either by refrigeration or kept in a cooler filled with ice packs. Cooling the sample prevents excessive bacterial growth, which occurs at warmer temperature and will skew the reported results.

Sampling methods used to meet the NPDES permit monitoring requirements are required to conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR

Part 136, or in the latest revision of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association.

7.3 Sample Types

There are three types of samples taken for wastewater laboratory analysis. Synopses of these testing methods are listed below.

7.3.1 Grab Samples

A grab sample is a single sample that reflects only the condition at the instant of sampling at a particular location. Grab samples are taken:

1. When the wastewater is well mixed, and considered to be representative of the conditions at the time of sampling (e.g., a grab sample of the mixed liquor within the AeroMod aeration basins).

2. When appearance of the wastewater changes rapidly.

3. When making sure a composite sample is not masking extreme conditions of the wastewater.

4. When test sampling time is so limited that grab samples must be used. In this case, samples should be taken at the time when the treatment system is operating under maximum load (which usually occurs between 9:00 a.m. and noon).

7.3.2 Composite Samples

A composite sample is a combination of samples taken at selected time intervals, for a specified period. The samples may be of equal volume, or may be proportional to the flow at the time of sampling. This type of sampling is representative of the wastewater of a select period of time, usually a 24-hour period. Influent composite samples are generally used to determine the quality of the wastewater to be treated. Effluent composite samples are generally used to determine the efficiency of the plant's treatment processes.

Where composite samples are required, they are normally collected by the automatic sampling equipment described in the following section. In the event that the automated composite samplers malfunction, the composite sampling must be done by hand. There are several different methods that can be used for composite sampling by hand. The choice is left to the operator to determine and should be based on the nature of the sewage flows and the number of available personnel and their time.

7.3.3 Bacteriological (Coliform) Sampling

Grab samples used to determine fecal coliform in the plant effluent should be collected in bottles that have been cleaned and sterilized for this purpose. Sterilized bottles must remain sealed until the moment of sample collection. The bottle is filled without rinsing, taking care not to contaminate the stopper or the neck. Bacteriological testing should be started as soon as possible after the successful sample collection. If questions or uncertainties remain about the coliform sampling and testing process, the Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association for detailed procedures for sterilization and sample collection should be consulted.

7.4 Sampling Equipment

The Plummer wastewater treatment plant is equipped with two automatic composite samplers, one located on the inlet pipe to the influent lift station which is used to collect composite samples of raw wastewater, the other is located downstream of the UV disinfection channels and is used to collect effluent composite samples. These samplers are self-contained, house the sampler and sample bottles, and are refrigerated to slow bacterial growth.

Under normal plant operation, samples are collected at equal time intervals. The volume of wastewater sampled depends on operator experience with the required testing parameters. Complete operating instructions for these refrigerated composite samplers are included in the manual supplied by the manufacturer.

The composite sampler tubing may develop a slime growth that can possibly slough off during sample collection and skew sampling results. Periodically flushing the lines with a chlorine solution or hot soapy water can help to eliminate this problem. When using either method, it is imperative that the lines be thoroughly rinsed before being placed back into service. In the event of extreme sample tubing fouling, the tubing can be replaced as needed.

7.5 Sampling Program

The testing schedule that will be established within Section I of the City's future NPDES Permit (and as shown on Table 23 in this Manual) lists the sampling and testing needed to monitor for compliance with effluent limitations. It is important to note that this testing schedule does not provide the treatment plant operator with performance information necessary to make process modifications or to correct problems within various treatment plant process units. Table 23 below presents a wastewater testing schedule that addresses both compliance with effluent limits and process control needs.

Table 23 - **NPDES Permit Sampling Schedule**

Sample	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Influent/Effluent	BOD_5	mg/l	LS-1/LS-2	1/week	24-hr. Composite
Wastewater Influent/Effluent	BOD_5	lbs/day	LS-1/LS-2	1/week	Calculation
Wastewater Influent/Effluent	TSS	mg/L	LS-1/LS-2	1/week	24-hr. Composite
Wastewater Influent/Effluent	TSS	Lbs/day	LS-1/LS-2	1/week	Calculation
Wastewater Influent/Effluent	Phosphorus	mg/L	LS-1/LS-2	1/week	24-hr. Composite
Wastewater Influent/Effluent	Phosphorus	lbs/day	LS-1/LS-2	1/week	Calculation

Sample	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Influent/Effluent	pH		LS-1/LS-2	1/week	24-hr Composite
PREM Influent/Eflluent	pH	mg/L	B-line meter vault/ V5	continuous	Sample Pump
PREM Influent/Eflluent	OP	mg/L	B-line meter vault/ V5	continuous	Sample Pump
Aeration Basins	Dissolved Oxygen	mg/L	A.B. 1 & 2	continuous	D.O. probes
Aeration Basins	Mixed liquor Suspended solids	mg/L	A.B. 1 & 2	1/day	grab
Aeration Basins	Mixed liquor volatile Suspended solids	mg/L	A.B. 1 & 2	1/day	grab
Aeration Basins	Settleability	ml/L	A.B. 1 & 2	1/day	grab
Aeration Basins	SVI	---	A.B. 1 & 2	1/day	grab/ calculated
Aerated Digesters	Total Solids	mg/L	A & B train digesters	2/week	grab

In addition to the wastewater testing schedule shown in Table 23, the City will need to conduct tests on the waste sludge removed from the treatment process. Table 24 below shows a biosolids testing schedule that complies with the biosolids permit. All samples are grab samples. All listed parameters are to be sampled from both the hauling vehicle (used to transport sludge from the treatment plant to the application field) and the application field soil. Table 22 in section 6.9 of this Manual lists ceiling concentrations for pollutants in the land applied sludge.

Table 24 - **Biosolids Testing Schedule**

Parameter	Units	Sample Points	Minimum Sampling Frequency
Arsenic	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Cadmium	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Chromium	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Copper	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Lead	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Mercury	mg/kg	Trailer	1/month

Parameter	Units	Sample Points	Minimum Sampling Frequency
		Field in application area prior to application	1/year
Molybdenum	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Nickel	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Selenium	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year
Zinc	mg/kg	Trailer	1/month
		Field in application area prior to application	1/year

7.6 Laboratory Tests

7.6.1 Procedures

The basic references for detailed laboratory testing procedures are:

1. Standard Methods, current revision
2. EPA – Methods for Chemical Analysis of Water and Wastewater
3. ASTM Standards

7.6.2 Description and Interpretation

Brief definitions for each of the required laboratory tests and specific application to the City of Plummer treatment plant are included in this section.

7.6.2.1 Temperature

The temperature of influent sewage varies throughout the year in response to the seasonal climate and cannot be controlled by the operator. A record of influent temperatures should be kept to help indicate these seasonal temperature trends. Sudden changes in influent wastewater temperature should be investigated as they can represent inflow connections or other non-permitted discharges. Effluent temperatures should also be documented since a running correlation between water effluent temperature and treatment plant efficiency can be useful.

7.6.2.2 Biochemical Oxygen Demand (BOD)

Testing BOD is the traditional method used in determining the oxygen that is required to biologically stabilize the organic matter that is present in wastewater, and furnishes an indirect measure of wastewater strength. Concentrations of BOD correlate to the amount of organic matter present in sewage. It is widely used to evaluate the efficiency of various treatment processes and to estimate pollution effects in receiving water bodies. BOD test results are generally reported as a concentration in units of milligrams per liter (mg/l) of oxygen consumed within a five day period (BOD_5). Within a sample, the difference between BOD_5 and BOD_u should be understood. Ultimate BOD (BOD_u) represents the amount of oxygen consumed at the end of an extended test period, not the amount of oxygen consumed within five days.

Generally, BOD tests are run on composites samples of influent and effluent wastewater to help determine the overall treatment efficiency and NPDES permit compliance on effluent limits. Spikes in influent BOD concentration are generally an indication of illicit discharges into the collection system and should be investigated. It may be necessary to run BOD tests on intermediate process units (e.g. AeroMod Effluent, belt filter press filtrate) to help isolate problems that can occasionally develop.

For reference, information on the BOD testing procedure can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater. This procedure will not be conducted in the foreseeable future at the Plummer treatment plant laboratory.

7.6.2.3 Total Suspended Solids (TSS) and Mixed Liquor Suspended Solids (MLSS)

The undissolved solids in wastewater are known as suspended soilds. The concentration is determined by drawing a sample of known volume through a paper disc, followed by drying the paper and weighing to determine the amount of solids retained. The suspended solids test is run on composite influent and effluent samples where the results, like a BOD test, are used as a barometer for treatment efficiency and compliance with effluent permit limits.

Results of suspended solids tests are an indicator of organism concentrations present in the mixed liquor within the aeration basins of the AeroMod. Mixed liquor suspended solids (MLSS) levels are one of the primary operation parameters for activated sludge treatment.

Information on the TSS testing procedure can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater.

7.6.2.4 Volatile Suspended Soilds (VSS) and Mixed Liquor Volatile Suspended Solids (MLVSS)

Volatile suspended solids are those suspended solids that can be burned off from a total suspended solids sample at 550° C. VSS are used as an indication of the amount of organic material remaining in sludge or mixed liquor. Whenever total suspended solids tests are run on the mixed liquor, the volatile suspended solids test should also be run. Information on the VSS testing procedure can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater.

7.6.2.5 pH

pH is a term used to express the intensity of the acid or basic concentration of a solution. The pH scale ranges from 0-14, where 7 is considered absolutely neutral. Acid conditions increase as pH values decrease, and alkaline conditions increase as pH values increase.

The influent pH should be measured wherever an unusual waste is seen or suspected. The pH of influent and final effluent streams, and the mixed liquor within the aeration basins are measured daily. Spikes or drops of pH values for the influent could be an indication of illicit waste discharges and should be investigated. Information on the pH testing procedure can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater.

7.6.2.6 Fecal Coliform

Fecal coliform bacteria are present in the intestines of all warm-blooded mammals and are used as an indicator organism to determine the effectiveness of the treatment plants UV disinfection system. Fecal coliform analysis is only conducted in an off-site laboratory at the time this manual has been prepared.

7.6.2.7 Dissolved Oxygen (DO)

Dissolved oxygen represents the amount of oxygen in solution, or dissolved, in a liquid. The solubility of oxygen in fresh waters ranges from 14.6 mg/l at 0°C to about 7 mg/l at 35°C. The solubility of oxygen is at a minimum when temperatures are at their highest. In wastewater testing, dissolved oxygen measurements are used to monitor aerobic conditions in the mixed liquor and final effluent.

Influent DO concentrations cannot be controlled by the operator, but should be monitored to detect any changes. Dissolved oxygen is one of the principal operating parameters used in controlling operation of the aeration basins. DO levels in the aeration basins are continuously monitored by probes which correspond to the amount of air delivered by the blowers. Information on the DO testing procedure can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater.

7.6.2.8 30-Minute Settleability

The 30-minute settleability test is the volume occupied (in ml/l) by settled mixed liquor at the end of a 30-minute period. The volume occupied by the sludge can also be recorded at other time intervals (e.g., 5,10,15,20,30,45 and 60 minutes). For purposes of comparison, a consistent time interval should be used. The result of the test gives a quick indication of mixed liquor characteristics, which can be correlated with age and concentration of the organisms. It can be helpful in determining the appropriate time to waste sludge. Information on the 30-minute settleability test can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater.

7.6.2.9 Sludge Volume Index (SVI)

The sludge volume index (SVi) is the volume, in milliliters, occupied by 1 g of a suspension after 30 minutes of settling. SVI typically is used to monitor settling characteristics of activated sludge and other biological suspensions. The procedure is the same as that described for the 30-minute settleability test. The SVI is calculated as follows:

$$\mathbf{SVI} = \frac{\text{settled sludge volume (ml/l) x 1000}}{\text{MLSS (mg/L)}} \quad \textbf{or} \quad \mathbf{SVI} = \frac{\text{settled sludge volume (ml/l)}}{\text{MLSS (mg/L)}}$$

Information on the SVI test can be found in the EPA Manual of Methods for Analysis of Water and Waste and in the latest revision of Standard Methods for the Examination of Water and Wastewater.

8 RECORD KEEPING

8.1 General

An important factor in an efficient wastewater treatment system is accurate operation and financial record keeping. The identification of trends helps future operators know when variations in operational performance occur. Keeping operational cost documentation is essential in preparing future operational budgets. The absence of accurate records prevents plant operating personnel and management from maintaining control over the facility. These records are also of great importance to the City when modifications to the plant are required.

There is a significant amount of data that is generated through daily operation and it should be recorded daily. It is imperative that a neat and accurate system of record keeping be maintained for both operational control and monthly report preparation. Operation reports should include laboratory test results as well as other information pertaining to energy usage, weather conditions, additional labor, time and costs of equipment repair or maintenance, notes on equipment performance and quantities of supplies and chemicals that are needed to effectively run the wastewater treatment facility. Process control monitoring used for plant operation should be kept separate from effluent quality and influent load monitoring as the process control monitoring records are for the operator's benefit and the water quality records are for DEQ reporting purposes.

There are several types of records that should be kept at the treatment facility. The records will be discussed in the following order:

- Daily Operating Log
- Laboratory Records
- Monthly Operating Report
- Personnel Records
- Emergency Conditions Records

8.2 Daily Operating Log

The treatment plant's head operator should keep an up to date log of daily plant activities. The log should be updated as individual activities occur and should be kept either in a bound, hand written notebook or on a computer. If an electronic log is kept, a backup must also maintained. Generally, laboratory data is not included in the daily operating log as the purpose is to record general operating conditions of the plant. Examples of the information that should be included in the daily operating log are as follows:

- Operating changes that affect the treatment process
- Unusual conditions (equipment failures, change in wastewater consistency, etc)
- Process changes or malfunctions and if able, a probable cause
- Unusual odors
- Complaints from the community (noise, odor, etc.)
- Status of the extended aeration basin, phosphorus removal filters, UV disinfection
- Plant Visitors

The City of Plummer's Public Works personnel operate and maintain the sewer collection system. Changes to the collection system including construction, side sewer connections and cleanings should be recorded and kept in a separate log accessible to both the Public Works crew and the treatment plant operators.

8.3 Laboratory Records

Daily lab tests on influent sewage and effluent water quality will generate a significant amount of data that needs to be properly recorded and submitted. Either a bound log or electronic log should be kept with up to date laboratory results. If the electronic log is kept, a backup should be conducted daily at the end of the normal working day. Examples of what to include in the laboratory log are as follows:

- A summarization of lab tests run during a shift
- Sampling information (type, location, time, date, etc.)
- Comments on unusual conditions that may affect analysis of results
- A summary of chemical reagents used (including necessary calculations, standard solutions made, etc)

8.4 Monthly Operating Report

Laboratory testing results are to be submitted every month to the Idaho Department of Environmental Quality. A copy of the submitted results should be kept at the plant as a permanent record of the laboratory testing results.

8.5 Personnel Records

Files on operators of the treatment facility should kept to allow a comprehensive file of the training courses each operator has attended as well as operator certification records.

8.6 Emergency Conditions Records

An emergency conditions file should be kept as an independent document and should include items such as necessary by-pass reports, deteriorated effluent conditions, utility failures and major equipment breakdowns. The log should include all information pertinent to the emergency condition, including the nature, magnitude, length and summary.

9 RECOMMENDED MAINTENANCE SCHEDULES AND SPARE PARTS

9.1 Introduction

The Plummer wastewater treatment plant is a specialized and complex facility that must efficiently produce quality effluent and biosolids. Keeping the plant running as efficiently as possible includes a regular maintenance program.

A comprehensive maintenance program will help decrease the number of equipment breakdowns and increase the lifespan of the equipment. It will also help efficiently use manpower, ensure the treatment facility operates as designed, and ensure effluent limits are met. All treatment plant personnel and management must be in full support of the maintenance program for it to be successful. It should be understood by all treatment plant employees that by following the routine maintenance schedule, overall plant operation will benefit. The maintenance routine needs to be continuously updated, especially as equipment requirements, staff capabilities and maintenance costs change. Employees must be adequately trained and have access to proper tools for the program to be successful.

This section of the manual describes the basics of a routine maintenance program. Specific maintenance details for individual equipment are not included in this manual; please consult the individual manufacturer's information for all installed equipment, located in Volumes 1 – 9 of the Contractor-supplied O&M manuals.

9.2 Equipment Record and Maintenance System

Treatment plant personnel should use a filing system to track equipment maintenance and repair needs. A suggestion is to keep a card on each piece of equipment within the file. The system works as follows:

- Each major piece of equipment in the treatment plant has a master card. The master card contains information such as:

    Manufacturer/Model Number
    Serial Number
    Nameplate Data
    Manufacturer's Local Representative
    Maintenance Requirements
    Lubricant List
    Spare Parts

- Each piece of equipment has a recommended maintenance card for each maintenance interval: weekly, monthly, bi-monthly, 6-month and yearly maintenance requirements
- The routine maintenance cards are placed in folders based on the maintenance interval. Cards for all equipment requiring weekly maintenance are placed in one folder, monthly maintenance cards are placed in the corresponding folder, etc.
- Treatment facility personnel pull the folders for the specified interval, consult the cards and note the maintenance required. Once the maintenance is performed, it is recorded on the cards and they're returned to the file.

This system is just an example of one way to keep track of necessary maintenance. The operators are encouraged to modify the record keeping system if an alternative method provides the same organized maintenance routine. Any system that allows treatment plant personnel to spread out the work load and identifies when scheduled maintenance is to occur (e.g., monthly maintenance occurs at the beginning of each month) should be effective when kept up to date.

9.3 Warranty Provisions

The entire treatment facility is newly constructed and is covered by a one-year warranty period. During this period, the Contractor has the responsibility to repair, correct, or replace any equipment or material that fails to perform in accordance with what is specified within the contract. It is important to note that any unsanctioned alteration of equipment by treatment plant personnel may result in a voided warranty. Prior to any modifications, either the manufacturer or Contractor should be contacted to verify it will not void the warranty for that piece of equipment.

All equipment must be regularly serviced, according to manufacturer's directions in order to keep warranties valid. Even equipment that is not regularly used during the initial year following construction must be maintained and should be operated occasionally to help prevent problems associated with no use. The warranty should not be used as an excuse to not properly maintain a piece of equipment.

All warranty information for specific pieces of equipment can be found in the manufacturer's operation and maintenance manual.

9.4 Periodic Operation

As stated in Section 9.3, several pieces of equipment may receive infrequent use during normal plant operation. These include the standby generator, valves, alarm systems, and redundant equipment such as UV banks and blowers. These items should be checked periodically for proper function to ensure the equipment can function as designed, when needed. All equipment should be run periodically, to avoid loss of lubrication or other maintenance issues. The standby generator should be tested on a monthly basis.

9.5 Routine Maintenance and Lubrication – Major Equipment

Each of the manufacturer's operation and maintenance manuals should contain complete maintenance and lubrication procedures. This section does not describe the manufacturer's requirements in detail; rather it lists major components that require routine maintenance, stating the type and frequency of some general maintenance requirements for the specific pieces of equipment. This section is organized following the flow through the plant.

9.5.1 Influent Lift Station

Daily maintenance of the lift station includes inspection of the pumps and motors for excessive noise, vibration, overheating, and oil leakage. Lubricate pumps and motors per manufacturer's directions.

A visual inspection of the influent lift station's electrical control panels should be conducted daily. This inspection should ensure that all gauges, relays, component parts and accessory equipment are operating properly. Observing the amperage drawn while the pump motor is in operation and then comparing it to a previous reading can help ascertain if the pump motor is malfunctioning. On a regular basis, the lead pump should be alternated.

A maintenance log for the influent lift station should record pump run times and lubrication.

9.5.2 Headworks

The headworks area, including the bagging area, should be inspected and hosed down daily, to remove any foreign materials, solids or scum adhering to the floor, walls or equipment.

The static screens should be cleaned of solids once per day to facilitate proper operation and the screen faces should be sprayed once per week with pressurized hot water to remove any grease buildup.

During normal flows, one static screen will operate at a time. The screen in operation should be periodically switched to allow isolation valves associated with each screen to be exercised, preventing them from freezing in place.

9.5.3 Extended Aeration Treatment System

Catwalks and fiberglass grating should be kept free of debris for Operator safety.

Specific maintenance items can be found in Volume 3 of the Contractor-supplied Operation and Maintenance Manual. Within Volume 3, recommended maintenance can be found under the ClarAtor and Wall Aerators tabs.

The air compressor's desiccant dryer should be inspected monthly and refilled with new material as needed.

The Kaeser blowers should be checked regularly for belt tension and oil lube levels. See the Blower Manual in Volume 3 for more detailed maintenance procedures.

A log of performed maintenance for the AeroMod and its components should be kept in the Plant's office for consultation and performance record.

9.5.4 Phosphorus Removal Filters

A complete maintenance program for the BluePRO phosphorus removal filters can be found in Volume 5 of the Contractor-supplied Operation and Maintenance Manual.

Normal maintenance requirements include removing the airlift pump twice a year for inspection and cleaning, as well as removing the air fittings at the bottom end of the airlift pipe and cleaning the screen as necessary.

The air lift removal can be done without draining the filter; however if the filter needs to be drained, please follow the detailed instruction found in Contractor-supplied Volume 5 of the Operation and Maintenance Manual.

All control panels should be inspected on a regular basis for corrosion and operability. Follow the detailed operation and maintenance instructions if the panels are found to be in need of repair.

The PREM catwalk should be kept clean and free of debris. Care should be taken not to allow large particles through the grates of the catwalk as clogging of the filters may occur, preventing proper performance.

9.5.5 UV Disinfection System

A daily visual inspection should be conducted on the UV disinfection system and control panels. Any alarms or malfunctions will be displayed on the control panel screen. Alarm conditions require immediate attention, where as lamp conditions are solved by general maintenance. The elapsed time meter and UV intensity monitor, within the control panel, should also be checked. The elapsed time meter indicates the number of hours the lamps have been active, while the intensity monitor is indicative of the amount of UV radiation being transmitted to the effluent.

The cleaning frequency required for the UV system depends on the quality of the effluent from upstream processes and chemical constituents within the wastewater. The quartz sleeves that house the lamps foul as particles adhere on their surface. Increased fouling correlates to decreased UV lamp intensity and requires removal of the buildup in order for the UV system to remain effective. The UV modules should be removed individually and placed on the cleaning rack for cleaning with the citric acid cleaning solution. It is imperative that rubber gloves and protective eye wear must be worn when cleaning the modules. Care should be taken to avoid excessive handling of the modules as they are easily damaged.

The manufacturer's operation and maintenance manual should be consulted for any operation problems that may occur with the UV disinfection system. Spare UV lamps and quartz sleeves have been provided in the event the lamps or sleeves malfunction. Each lamp should provide at least 8,760 hours of operation. If a lamp fails to meet 8,760 hours of operation, Infilco Degremont, Inc, by warranty, will provide a replacement lamp at no cost to the owner.

9.5.6 Effluent Lift Station

Similar to the influent lift station, daily maintenance of the effluent lift station includes inspection of the pumps and motors for excessive noise, vibration, overheating, and oil leakage. Lubrication of the pumps and motors should be per manufacturer's directions.

A visual inspection of the effluent lift station's electrical control panels should be conducted daily. This inspection should ensure that all gauges, relays, component parts and accessory equipment are operating properly. Observing the amperage drawn while the pump motor is in operation and then comparing it to a previous reading can help ascertain if the pump motor is malfunctioning. On a regular basis, the lead pump should be alternated. In addition, power supply to the hot box on the effluent lift station lid should be checked monthly to ensure proper operation.

A maintenance log for the influent lift station should record pump run times and lubrication.

9.5.7 Sludge Dewatering Equipment

Sludge will not be wasted from the aerobic digesters on a daily basis. It is expected that the dewatering equipment will be run less than 8 hours per week. This decreased operation allows a more infrequent maintenance schedule as daily maintenance will not be required. This section flows through the components of the dewatering process. Starting with the sludge pump drawing from the aerobic digesters, to the polymer feed system, to the belt filter press, then to the cake pump discharge, this section mimics the sludge flow.

The progressive cavity sludge pump that draws waste activated sludge from the aerobic digesters is located in the Mechanical Building's belt filter press room. This pump should be checked on each day of operation for overheating, unusual noise or vibration and oil leakage. As with the pumps associated with each lift station, periodic inspection of bearing lubrication is essential and additional oil and/or grease should be added as necessary. Care should be taken to avoid adding too much grease or excess oil. All lubrication should be done per manufacturer's instructions.

Visual inspections of the sludge pump's electrical control panel should occur on each day of operation to ensure that all gauges, relays, and additional components are operating as specified. A maintenance log should be kept to keep track of all routine maintenance performed on the pump.

The polymer feed system should be checked weekly (due to non-daily use) for clogging and control system malfunctions. The manufacturer's operation and maintenance manual should be consulted before conducting repairs or maintenance.

The routine maintenance for the 0.8m Tritan belt filter press includes the general visual inspection that looks for overheating, unusual noise or vibration during use. After every ten hours of operation, all washing manifolds should be inspected and verified to be working properly. The belt should be viewed through the safeguards and verified to be clean. If any spotting or striping is observed, the nozzles should be inspected for blockage and cleaned or replaced.

After every 40 hours of operation, the belt filter press should be cleaned and greased. Additional maintenance requirements should be followed after 160 and 500 hours of operation. Please see Volume 4 of the Contractor-supplied Operation and Maintenance manual for these requirements. Additional instructions for belt replacement

Following dewatering, a 5 HP cake pump moves the dewatered biosolids from the belt filter press to the trailer in the covered sludge storage area. The cake pump should be observed for any signs of excessive noise or vibration during use. The control panel should also be inspected to ensure proper operation. The sludge discharge pipe is equipped with an air blast to purge remaining solids from the pipe to prevent the solids from freezing. It is imperative that after every use, the air blast be activated.

Upon filling the trailer beneath the covered sludge storage area, the dewatered biosolids should be trucked to the offsite storage located on the land application area. The biosolids should be stored here until the City is ready for land application utilizing a tractor equipped with a manure spreader. The biosolids do not need to be covered at this offsite location, however, if the City chooses to cover the pile, it is recommended a heavy plastic tarp or geomembrane be used to improve durability.

9.5.8 Automatic Samplers

There are two refrigerated composite samplers located in the Plummer Wastewater Treatment Plant. One sampler is located at the upstream of the influent lift station (LS-1), and samples the incoming raw wastewater. The other sampler is located downstream of the UV disinfection system and samples the plant's effluent for discharge permit compliance. It is possible that a slime growth, normally associated with bacteria, can develop within the sampler tubing (especially in the influent sampler) which can slough off during sampling, interfering with the testing results. To prevent the fouling of the tubing, it is necessary to flush the tubing with a medium strength chlorine solution or hot soapy water. After flushing, the tubing must be thoroughly rinse before being put back in operation as remnants the chlorine solution or soapy water can also skew test results. If the fouling is substantial, the tubing must be replaced. See the manufacturer's operation and maintenance manual for replacement directions.

9.5.9 Standby Generator

The standby generator is located north of the Mechanical Building, adjacent to the gravel driving surface. Components of the generator should be kept free of dirt and debris buildup and inspected for oil and fuel leaks on a daily basis.

The standby generator should be started monthly to keep internal components lubricated. Per usual, during operation, the generator should be inspected for excessive vibration, noise and overheating. The minimum run time for the monthly test should be 30 minutes, although an hour is preferred. During the test, all gauges should be observed to be in proper working order and the exhaust system should be visually inspected for leaks. The fuel tank should also be checked during the monthly inspection, and at a minimum, should be kept at least half full at all times. All air intakes and exhaust should be checked for blockage as they need to be kept free of debris at all times. In addition, the electrical connections and bearing temperature should be checked monthly during the test period.

On an annual basis, or after 3,600 hours of run time (whichever occurs first), the bearings on the generator should be re-lubricated according to manufacturer's directions. The following Table 25 should be used as guide for scheduled maintenance. This table is to be used as a general reference, as the maintenance requirements in the manufacturer's operation and manual takes precedence.

Table 25 – **Standby Generator Preventative Maintenance Checklist**

Description	Daily or after 8 hours	Weekly or after 50 hours	Monthly or after 100 hours	3 Months or after 250 Hours	6 Months or after 250 Hours
Operate Standby Generator					
Inspect Standby Generator					
Check Coolant Heater					
Check Oil Level					
Check Fuel Level					
Check Air Intake					
Check Air Filter (Replace if Required)					
Check Battery Charging System					
Drain Fuel Filters					
Drain Water/Sediment from Fuel Tank					
Check Antifreeze and DCA Connection					
Check Drive Belt Tension					
Drain Exhaust Condensate Trap					
Check Starting Batteries					

Change Crankcase Oil and Filter					
Change Coolant Filter					
Clean Crankcase Breather					
Change Air Cleaner Element					
Check Radiator Hoses for Wear and Tear					
Check Governor Adjustment					
Change Fuel Filters					
Clean Cooling System					

[1] Check for oil, fuel cooling and exhaust system leaks, and repair any leaks immediately.
[2] Perform more often in dusty summer conditions.
[3] Visually check belt for evidence of wear or slippage. Replace if hard or brittle.
[4] Drain 1 cup or more of fuel to remove water and sediment.
[5] Refer to engine operation and maintenance manual for procedure.

9.5.10 Operation and Mechanical Buildings

Both the Mechanical and Operations Buildings should be swept and thoroughly cleaned once per week. Floors in process areas should be hosed down weekly or more frequently, as needed. Floors within the laboratory and office areas should be mopped to be kept clean on a weekly basis. Pieces of equipment used within each of the buildings for operational comfort, laboratory work, etc. should be kept in operating condition and replaced if broken. All alarms, switches, and valves should be operated on a monthly basis to assure they are functioning properly.

10 EMERGENCY OPERATING AND RESPONSE PROGRAM

10.1 General

The purpose of an emergency response program is to reduce adverse effects from an unexpected emergency circumstance that affects the treatment system. To mitigate harm in emergency situations, it is important that an emergency response procedure be in place that provides direction for all personnel so individual responsibilities are known prior to the event occurring.

The wastewater treatment plant's operational staff should be equipped to deal with emergencies including but not limited to natural disasters, such as flooding, high winds and sustained sub-zero temperatures, accidents, toxic spills, and faulty/negligent maintenance and operation.

10.2 Responsibility

It is the responsibility of the supervising operator to maintain the emergency response program and to be familiar with the Disaster Relief Act of 1970. In addition, the supervising operator needs to be familiar with the Federal Disaster Assistance Program to ensure federal assistance, if needed, can be received in a prompt and efficient manner.

10.3 Emergency Response Program

At a minimum, the emergency response program needs to include the following components; inventory of emergency equipment, review of alternative operating modes, coordination with local police and fire departments, coordination with local utilities, coordination with other City services and a preventative maintenance program.

The emergency repair contacts developed at the time this manual was assembled include the following:

1. Air Compressor – Ingersoll Rand. Contact Dave Kautz, 509-590-3711 (cell) or 800-431-7305
2. Electrical Controls – Taurus. Contact Carl, 503-519-4547
3. Electrical Systems – Challenger. Contact Tye, 208-861-2893 (cell) Or 208-461-0608
4. Overall Systems - Contractors Northwest Inc. Contact Matt Nason, 208-659-5914 (cell) or 208-362-9656
5. Overall Systems – Engineering – USKH Inc. Contact Alan Gay, 509-953-5455 (cell) or 509-328-5139

A placard with this list has been prepared for posting in the operations building office of the wastewater treatment facility.

10.3.1 Inventory of Emergency Equipment

The following emergency equipment should be readily available on site at the wastewater treatment plant: fire extinguishers, breathing apparatus, portable engine-drive pump, air compressor, spare parts, and tools. In order to keep current on the emergency available onsite, an emergency equipment inventory sheet should be prepared and kept with this O&M Manual and in an emergency response file. The more comprehensive the document, the better, as coordination with other City departments increases the emergency response ability. If there is equipment owned by local businesses or the Coeur d'Alene Tribe that will aid in emergency response, this equipment should be included within the inventory and mutual aid agreements should be completed. The inventory should be conducted by the supervising operator and updated on a yearly basis, ensuring the information it contains is accurate. An example sheet for the inventory is included at the end of this section.

10.3.2 Alternative Operating Modes

Alternative operating scenarios are discussed in Section 6 of this manual. All operating personnel must be thoroughly familiar with the steps involved in switching from one mode to another and should be competent in the bypass of treatment plant processes if the need arises.

10.3.3 Coordination with Police and Fire Departments

It is important that emergency personnel be able to access the treatment facility in the event of an emergency. It is highly recommended that representatives from the police and fire departments be invited to inspect the site and facilities for accessibility and to develop their own emergency response contingencies to address scenarios specific to their duties.

It is desirable to coordinate access to the perimeter gate locks by providing duplicate keys to emergency response departments.

10.3.4 Coordination with Local Utilities

As the City is the local power, water and sewer provider, coordination should be straight-forward within the public works department. However, planning for changes to any utilities should be coordinated and well thought-through prior to implementation. It is highly recommended that such planning be coordinated through the City's engineer.

10.3.5 Coordination with Other City Services

The City of Plummer's Public Works Department has been deeply involved with the construction of the treatment plant, as they were in charge of operating the previous lagoon system. They will continue to coordinate with the supervising treatment plant operator and will be able to assist in emergency situations.

10.3.6 Preventive Maintenance

Proper and timely maintenance of all equipment within the treatment plant will help minimize emergencies associated with equipment failure. Section 9 outlines proper maintenance for process equipment and the Contractor-supplied manufacturer's operation and maintenance manuals in Volumes 1 - 9 explore the regular maintenance necessary in greater detail.

11 PERSONNEL

11.1 General

As the Plummer Wastewater Treatment Plant is a large investment for the City of Plummer, and significantly more complicated that the lagoon treatment plant, it is imperative qualified personnel are hired to run the facility. It is the City of Plummer's responsibility to adequately staff the treatment plant and to ensure that the treatment plant equipment is kept free from damage and deterioration in excess of normal wear and tear and to ensure the treatment plant operates as efficiently as possible.

The State of Idaho (through IDAPA 58.01.16) requires that the supervising operator with a tertiary treatment stage be certified as a Class III (or higher) operator. Due to the tertiary phosphorus removal filters in the Plummer Wastewater Treatment Plant, the City of Plummer is required to employ at least a Class III operator. Other operators, assisting the supervising operator may be certified as one class lower, Class II.

11.2 Staffing Requirements

A method for estimating treatment plant staffing requirements was formulated by the U.S. EPA in their publication, *Estimated Staffing for Municipal Wastewater Treatment Facilities.* Staffing requirements, according to the document, are based on the size of the treatment plant, the layout, process components, testing requirements, and other features.